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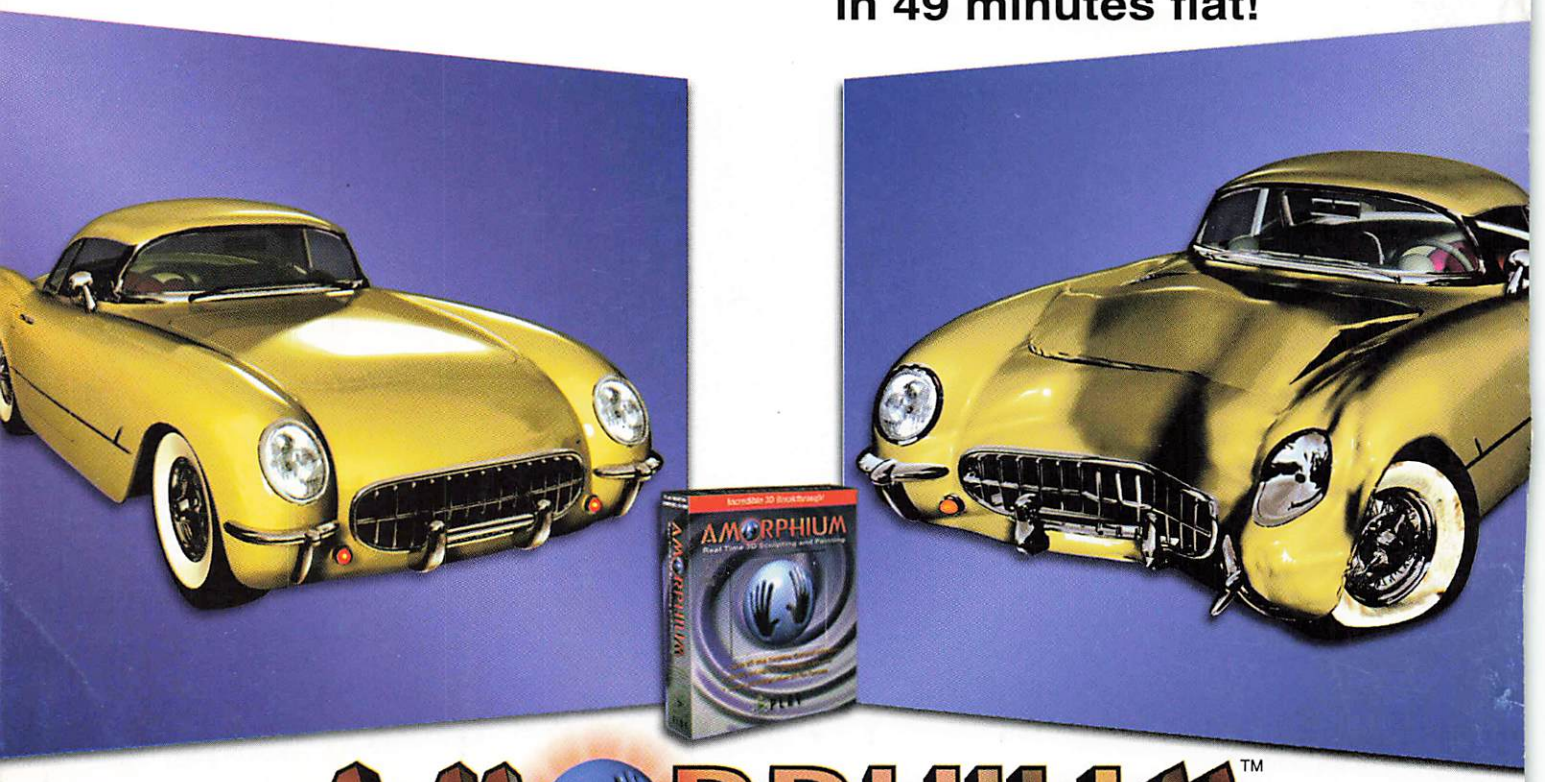

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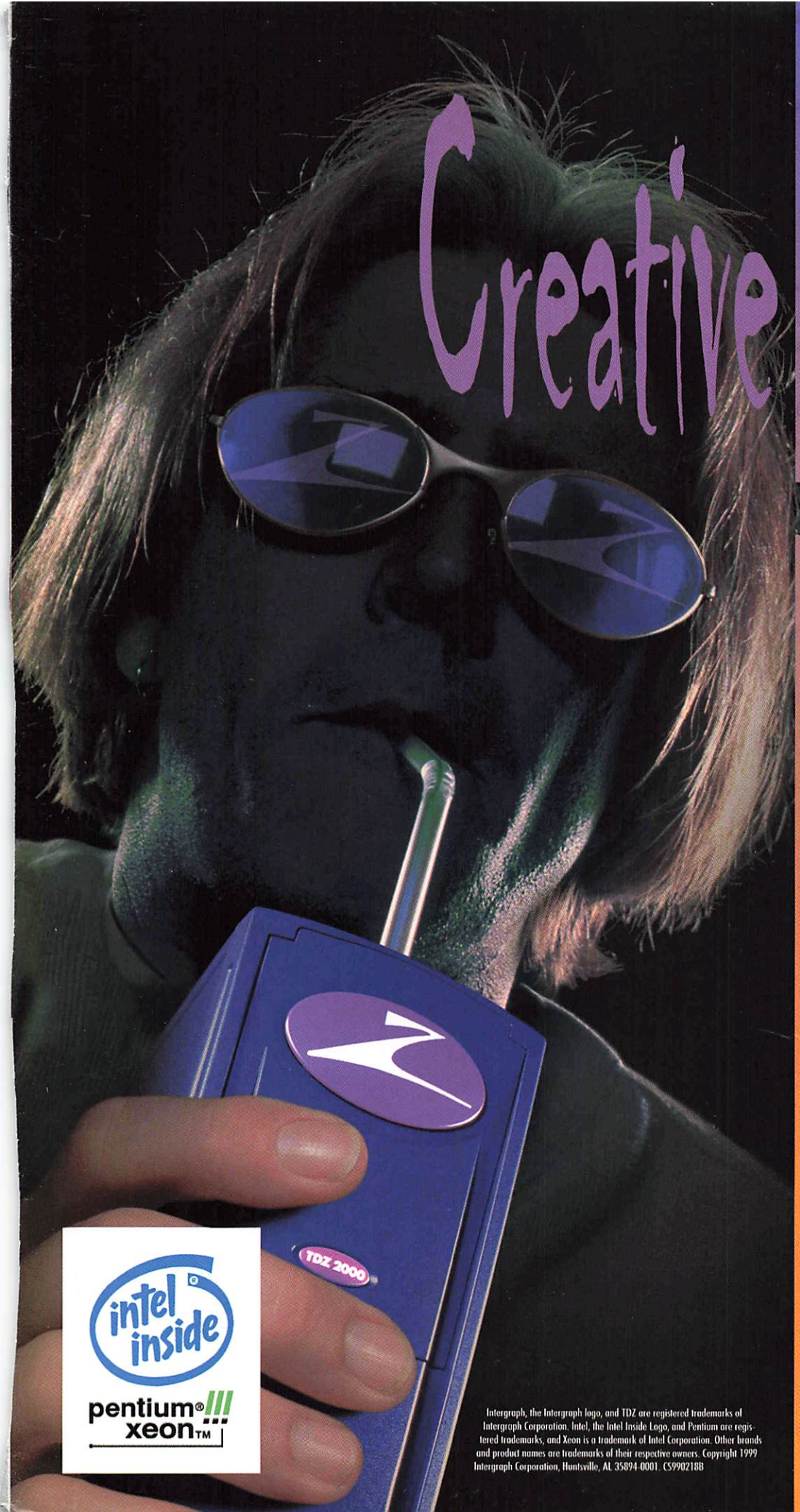

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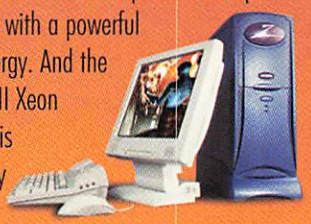

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Rapid 3D #51

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BY CHRIS TOME

Art Wanted—No CG

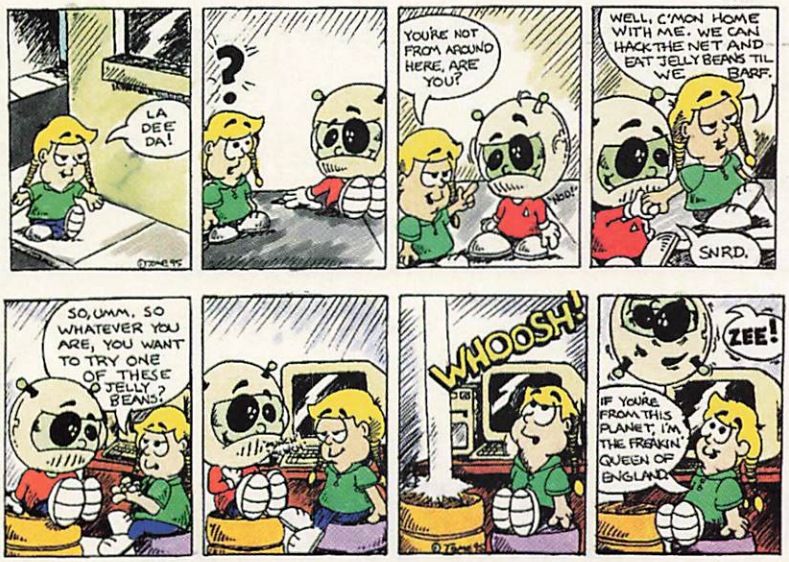
Ok, tutorial time. First step in the lesson is turn off your computer. And don't just power it down—unplug the sucker from the wall entirely, and don't go near it for at least 48 hours. "What?!?!" you say. This is a digital art magazine, right? The mouse doesn't work as well with the power off, right? Right. For the time being, we're going to focus on the art side of digital art, and for this, you'll need anything but your computer.

Now, before we get to step two, here's how I got to step one. About a week before the SIGGRAPH 99 show, I personally tie-dyed 21 vests for volunteers at The Studio at SIGGRAPH. The red, Target-employee type vests weren't doing it for me, so I volunteered to make custom ones in my copious spare time. So, after a stop at the nondigital art supply store, I spent two days destroying my bathroom, dripping ink on my carpet, and generally endangering my security deposit, all in the name of art. And boy, was it fun! Not only that, it was a Zen-like creative break from the norm. The vests were wildly popular, and I felt a new creative surge in my right brain, one that gets drained from using computers.

As much as computers are an integral part of many artists' lives, they're not extremely conducive to the creative process. Operating systems are cold and impersonal, and user interfaces require a lot of left-brain concentration, which can impede the creative flow. Traditional cel animation is an excellent example of where technology still loses out to a good old pencil and paper. Even though much of the ink and paint process has gone digital, 2D animation is still almost exclusively hand-drawn, then digitized.

So let's review. Step one: Turn off your machine and don't touch it for any reason, for two entire days. Step two: Grab a sketch pad, walk outside, and start sketching. Turn a lump of clay into a real sculpture. Melt crayons in a pan and pour wax on a piece of watercolor paper. Spatter paint all over something (your PC maybe?). Whatever you do, get back to the roots of traditional artistry, where there are no bits or bytes, no SCSI cables, no graphics cards. It's just you and your pencil, brushes, charcoal, or whatever floats your artistic boat.

This mission, should you choose to accept it, is not without its rewards. We're getting to the payoff. Make some cool analog art, create something to use in a future digital project, or create just for the sake of creation, and step three is send it to me! Why? You could win a copy of Meta-Creations Painter 6.0, the best tool around for simulating real-world brushes, pens, pencils, etc. This will have to work on the honor system: Please don't submit any previously created art. Do this project as much for yourself as for the prize, and you'll benefit from it. Then take a photo of your art, scan it, send it to me, whatever it takes. Visualize, and maybe you'll win a prize! Deadline is October 31. Boo!



XPL (that's icks-pul for you earthlings) is a mischevious little alien whose job was to come to Earth, learn about it, then blow it up. The only problem is that he has the mentality of a nine-year-old Earth boy, and with his curiosity, that's a cute but sometimes dangerous combination! Suzie Brite, the little girl who finds and befriends XPL, is eight, with the mind of a genius and the attitude to go with it. This is from a comic strip I started a few years ago. Don't forget that art doesn't require a CPU!

Chris Tome is technical editor for *3D* magazine and plays Santa with vendors' products as much as they'll let him. Email him at ctome@mfi.com. Snailmail him at 525 Market St., Ste. 500, San Francisco, CA 94105.

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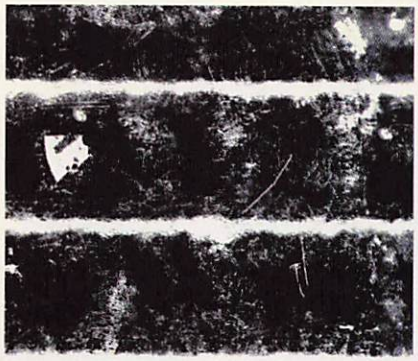

FIGURE 5. The bump map is basically a negative of the diffuse map.

mapping type to get them the way you want, so keep at it.

The transparency map is next. Just as the name implies, this map gives an object transparent properties. I don't think a barrel needs this type of mapping, so we'll save it for another day.

We're running out of maps, so our fun is coming to an end. We'll finish with a bang, though—the bump map (Figure 5). The bump map makes the renderer push the surface out ever so slightly, thus causing a bump or dent in the surface. This will take the flat look out of your renders and make them more realistic. Grab our friend the diffuse map again and do some noodling with the brightness/contrast until you get a surface contour you're happy with. Now, since we want the scratches to push outward, let's invert this image. Fantastic. Apply it to the surface generously. Then, pull back on the bump amount if you find you've taken the bump too high.

I did something else to my surface's color channel: I applied an alpha map to let the color channel use only the rusty part of the map. The alpha I ended up using was a copy of the bump map. You may find another map more effective; in that case, use it instead. Alphas are very handy when you only want to surface part of an object or want other textures to peek through.

Have you been hitting the render button to check your work? If so, you should have a nicely textured barrel by now (Figure 6). If your barrel doesn't look as realistic as mine, play with the texture opacity of the various maps. For some, you may want to dial down the opacity so the light can shine through just a bit and hit the surface.

Thus ends our first foray into texture mapping. We'll go into more detail in the future. Keep trying different techniques for applying maps, especially the diffuse and specular, because they're very important in making a photorealistic surface. Until next time, keep pushing the pixels.

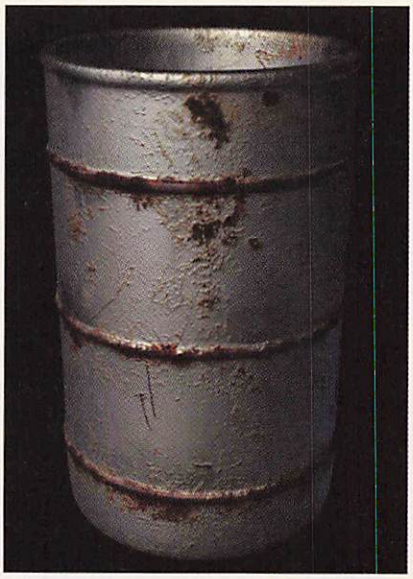

FIGURE 6. The finished barrel, in all its photorealistic glory.

Robert Nederhorst is a pixel coordinator and rendermonkey #3 at Digital Domain. You can contact him at throb@d2.com.

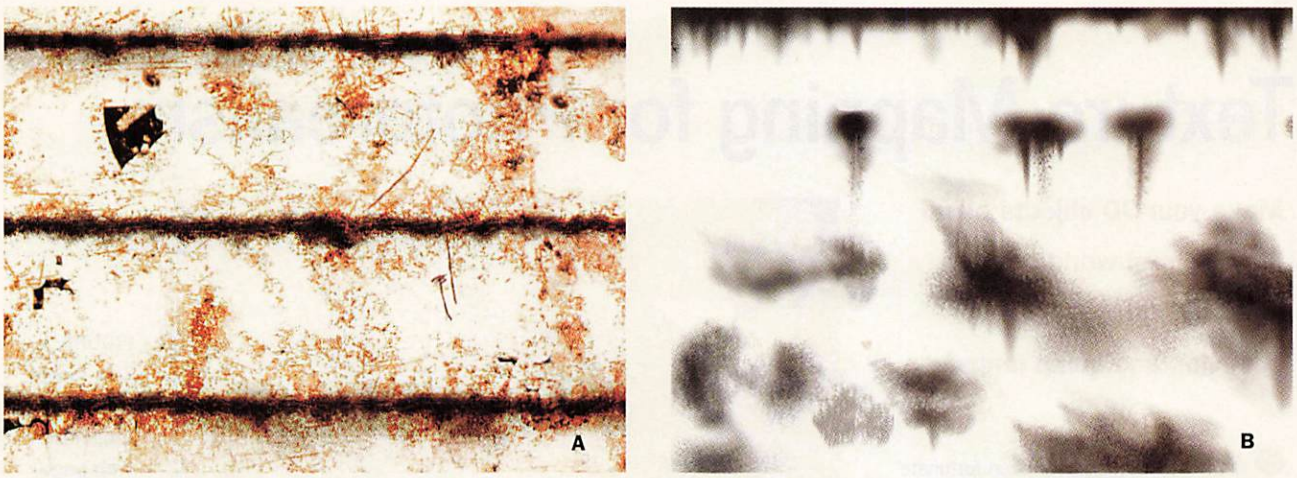

FIGURE 2. The barrel's color map. It consists of a grime layer (a) and an oil layer (b).

filter again and check for problems with the seams. None? Good.

Next in line (in LightWave, anyway) is the luminosity map. This map makes the surface self-illuminating. It's useful for things such as fluorescent panels and paneled lighting in a space ship. Since our barrel isn't that kind of funky, we'll skip this for now and come back to it in a future installment.

Now it's time for the diffuse map. Generally, it makes colors less saturated and reflections less sharp. This map is generally an image in 256 levels of gray, so convert the color map to grayscale in Photoshop. Next, play with the contrast and brightness. We want less light to play on the scratches, so make sure they're darker shades of gray, even black. The whites in the image will result in a pure diffuse value, so take it to a lower gray level (Figure 3).

For the oil layer, add the oil image we just painted. But if you just place it on top, it will mess too much with the lower rust layer. Instead, we'll use the alpha channel to determine which areas of the oil will be visible and which will be hidden. Where the alpha is white, the texture will show through; where you have dark colors, it won't; that is, white means 100% visibility and black means 0% visibility. The alpha for the oil layer is the negative of the oil map, so the oil layer won't disturb the rust layer. While the initial application of the oil layer may be too much or too little effect for your taste, you can always adjust the layer opacity settings. This is why we made a separate oil layer.

It's a good thing to have your paintbrush ready at all times, in case you want to add little scratches and dents. The diffuse map is a good place to add these flaws.

Now, we're on to the specular map, which tells the renderer where the shiny spots are on the surface. Another way to say it is that specularity is the reflection of light on the surface, the sheen, as opposed to the diffuse property, which determines where light plays on the surface. Take the diffuse map and crank up the contrast and brightness until you get well-defined areas of dark and light (Figure 4). Remember what we did with the oil map for the diffuse channel? Well, we'll do almost the same thing. This time, however, apply the negative of the original oil painting as the main specularity map as well as the alpha. Oil reflects more light, so the oily bits should have a heavier shine. Dial in the layer opacity as needed.

At this point, we have the three main components of the surface in place. It's time to check your render to see if you like what you have so far. It won't look totally realistic yet, but you should get a clear sense of how well it's turning out in this render.

Okay, on to the reflection map. This is yet another variant on the diffuse map. Dark areas generate less reflection and light areas generate more. This barrel may or may not have reflection. Personally, I don't think it should, but that's up to you. Once again, take the diffuse map and adjust the brightness/contrast until you're happy. If you're like me, it will take you a few tweaks per

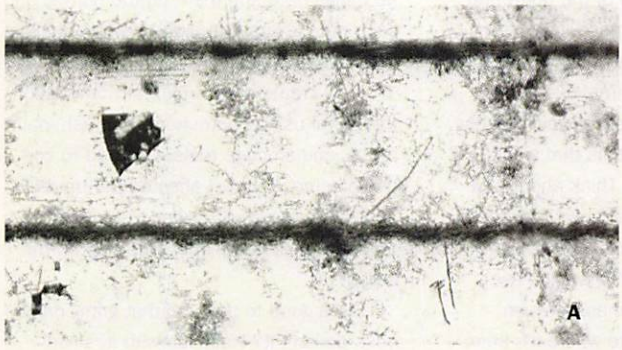

FIGURE 3. The diffuse map is a grayscale image derived from the color map by adjusting contrast and brightness.

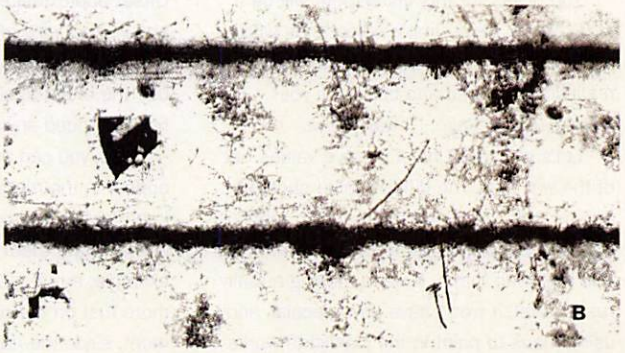

FIGURE 4. The specular map is derived from the diffuse map.

BY ROB NEDERHORST

Texture Mapping for Photorealism

Make your 3D objects blend into the real world through effective diffuse, color, specular, and bump maps.

FIGURE 1. This image from Jeremy Engleman's web page (www.art.net/~jeremy) served as a good starting point for my barrel's texture.

At Digital Domain, I've been fortunate enough to work on many different types of projects, including commercials, music videos, game cinematics, and film. In each installment of my column, I'll pass along techniques and insights gleaned from this work as it bears on issues of texturing, lighting, and rendering, especially when you're trying to create a photorealistic image. The information I'll be presenting owes a lot to my mentors and fellow artists, without whom I would never have learned much of it, and I hope it will benefit you as much as it has me. I'll be using NewTek LightWave in most examples, but almost everything will translate easily to other 3D packages.

Texture maps are a major part of the photorealism trick. If you do them right, they're not something you can quickly get in and out of. Doing good texture work is like painting a picture. After all, you're trying to create all the relevant details on an object's surface. Each map of a surface shader defines a different aspect of that surface. The trick is to take full advantage of all the various maps available to you to create a surface with complex characteristics.

The object for this installment will be a steel barrel. It's a simple object that, with some work, can be made to look totally realistic. Go ahead and build it in your favorite 3D package, I'll wait for ya.

Let's get some initial surface values out of the way first. The diffuse value should be around 20%. We'll add the rest with maps. Specular should be set to 0% because we'll add it all with maps. If we're making a really rusty barrel, it won't have any specular, and using maps to paint in the highlights works quite well. Let's set the initial color to a medium-to-dark gray, with a hint of blue (R=73, G=71, B=84). The color map can affect that color as well.

The color map is a good place to start. It tells the renderer which color(s) to place on the surface. Making a strong color map is especially important because it can provide a starting point for other maps. Generally, I generate all my other maps from the color map. In most cases, the best way to get started is to scan a pre-existing image or create one using a digital camera. For this exercise, I got an image (Figure 1) from Jeremy Engleman's web page (www.art.net/~jeremy), which includes lots of pictures that make good starting points for textures.

Once you have a good initial color map, it's time to make it seamless. We'll do this using the offset filter in Adobe Photoshop. Offset approximately half of the horizontal and vertical size of the image. Now, paint out the seams. When you're done painting, use the offset again and make sure you haven't added any seams with your painting.

Now, you can add details that would appear in the real world. Think about how imperfections in the surface would creep in, and recreate them as best you can. For example, a real steel barrel would have more rust on the ridges than between them, since the ridges are where it's been rolled on the ground, bumped against walls, and otherwise abused. Some parts might be nicked by a screwdriver. Get a few good scratches in there too. Take out areas that have too much grunge and grime, so you don't oversaturate the barrel with dirt.

The color map in Figure 2 was made using Photoshop's airbrush with a custom brush. (We'll look at how to make custom brushes and why I like them in a future installment.) I used two layers in addition to my original image layer. One was for extra color, and its Layer Apply mode was set to normal, with 70% opacity. The second layer used the color burn mode, painted with the same custom brush I used before. This added a nice background of dark grime and gunk where I painted extra scratch areas in the previous layer. I applied a wind filter to the color burn layer to make it a little more scratched. Then I went back and painted little things here and there on the normal and color burn layers to make the whole thing more organic-looking.

Let's create a new map for some oil on the barrel using Photoshop's airbrush, paintbrush, and smudge tools. I wanted to control how much the oil affected the barrel separately from the regular rust image, so I made a separate oil image to map on the barrel.

Feels good to paint all that grimy nastiness doesn't it? Have fun with it, since that's the whole point. Just to make sure everything is still good to go, use the offset

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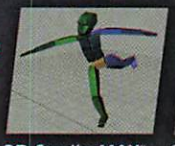
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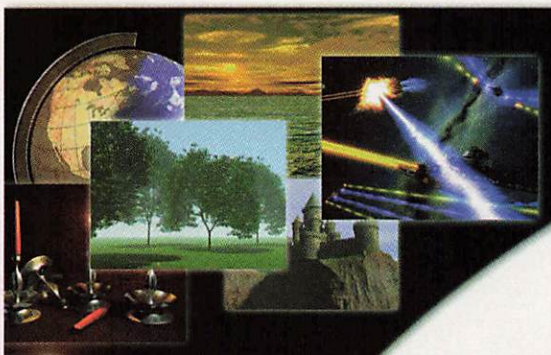

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pose reel by scanning the storyboard panels (if they're on paper) and importing them into a video editing program—I use Adobe Premiere, but any editing program will do—along with a rough soundtrack, if possible (Figure 2). Place the storyboard panels inside the editor's timeline and move, stretch, and clip them until the timing is right. Here, not in your 3D program, is where you should spend your trial-and-error time, visualizing the shot in your head or acting out bits of scenes to find out how long they take. Had I attempted to determine the timing for this shot from scratch while animating, for instance, I would almost certainly have left far too little time for the audience to absorb Dennis' initial pose before bringing him into the eating action.

Incidentally, *The Animator's Apprentice* poses a special problem for timing because every movement the characters make must be synchronized with a piece of music, Paul Dukas' "The Sorcerer's Apprentice." The pose reel showed me that the music would have to be altered in some passages, a challenge I've handed off to the composer arranging the score.

When you're finished constructing the pose reel, the shot will have been planned out from start to finish using only drawings and sound. In fact, the pose reel can serve as a template for the final edit of the movie. With the whole movie in this form, it can be evaluated and edited quickly. Each shot or sequence can be replaced bit by bit with test renders, then with finished shots, so you can always see what the film will look like as a whole.

This may seem like redundant work, but it isn't. With the pose reel as your guide, creating the animation itself is more efficient and more fun. It enables you to concentrate on the nuances of character motion without worrying that the big gestures will be totally off. It also allows you to make the animation equivalent of Stanley Kubrick's final check: Is there anything on the screen worth animating?

Once you have the timing worked out, the key to using it is an exposure sheet. An exposure sheet is simply a spreadsheet, either paper or software, in which each row represents a frame and space to write a description of the action that occurs on that frame. Exposure sheets were invented by the Disney studio early on, when it became necessary to record the exact timing of any given shot for use by animators, director, and cinematographer. Exposure sheets are less central to computer animation than to hand-drawn animation, since computers afford the luxury of nearly instant playback and editing. Nonetheless, they can be a useful reference when you're creating timing.

For this shot, I used an exposure sheet to record the pose reel timing in Premiere. I rendered the shot to a movie and brought it into my sound editor (the old workhorse Macromedia SoundEdit 16, but you can use any sound editor that lets you see movie frames as well as waveforms). I noted the timing of action and sound changes with frame accuracy and wrote them down on the exposure sheet. You can use any kind of line or graph paper as an exposure sheet—just remember you're going to need a lot of it!—but I prefer a spreadsheet (Figure 3).

The exposure sheet isn't used only to record timing information. It's also used to plan overlapping and secondary motions that were too insignificant to draw into the pose reel. Marking time on an exposure sheet and reading it easily is an acquired skill and takes some practice. I use a lot of little code words to describe the action. The word "hold" denotes a held pose, for instance, and the word "side" denotes a slight deviation or head turn in the middle of a larger action. If there's any dialog in the shot, I break down each word by phonemes (the basic mouth shapes that make up speech) using the sound editor and write it on the exposure sheet as well, along with any slight head and body gestures that go with a spoken phrase.

Next month, we'll look at various keyframing styles, and the following month, we'll make practical use of the techniques discussed in animating two actual shots.

Raf Anzovin is the co-founder of Anzovin Studio, based in Amherst, MA. A trailer for his upcoming film, *The Animator's Apprentice*, can be viewed at www.anzovin.com/films/apprentice. You can email him at raf@anzovin.com.

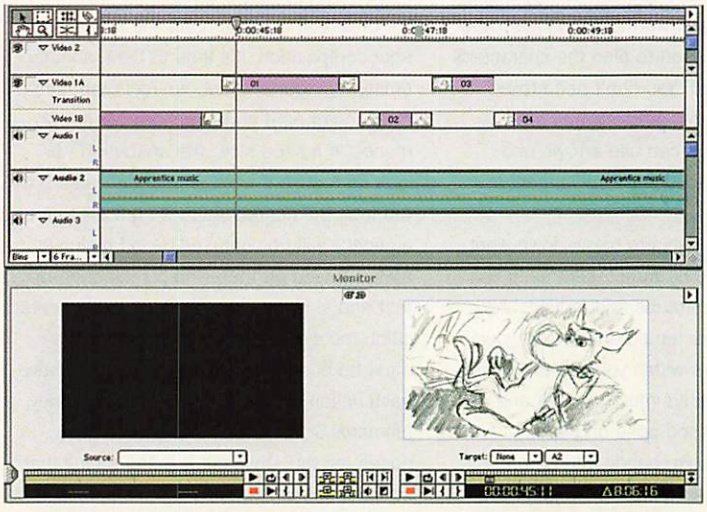

FIGURE 2. Timing can be worked out easily by laying out the drawings in a video editor to create a pose reel.

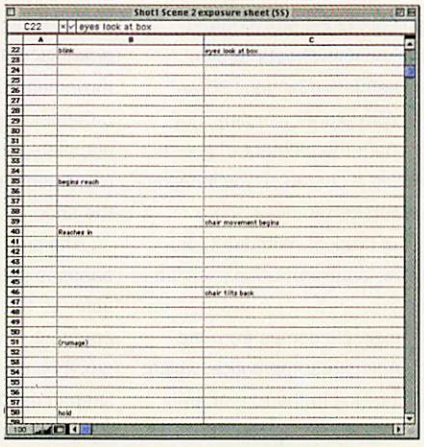

FIGURE 3. Use an exposure sheet to record timing from the video editor and work out timing for overlapping or secondary motion, such as eye blinks.

BY RAF ANZOVIN

Big Plans

The most important part of character animation is proper planning.

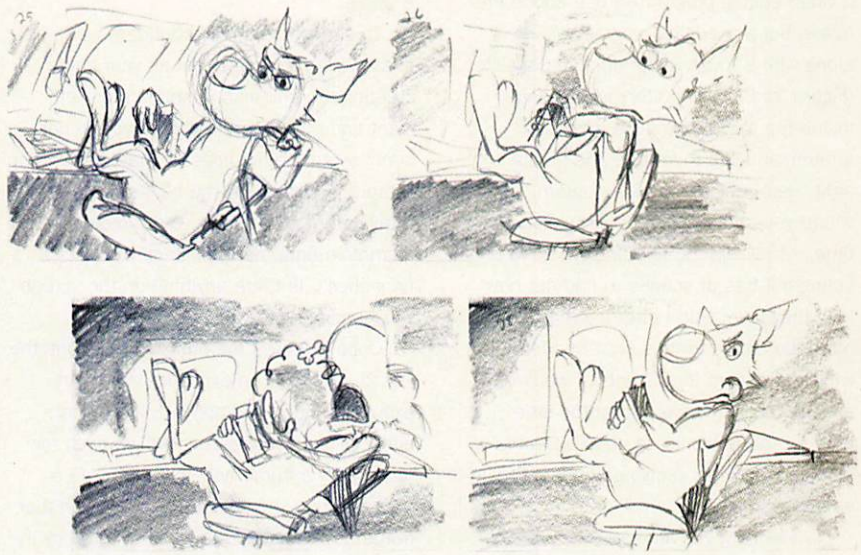

FIGURE 1. Four pencil drawings were used to plan the shot's poses and composition.

Get ready to embark on a journey through the life of an animated film, *The Animator's Apprentice*. In this regular column, I'll focus on character animation techniques that arise directly from this and other projects. In the past, I've been frustrated by articles that cover generalities without getting down to the nitty gritty of how to apply them in an actual production situation, so the emphasis will be on practical solutions to real-world problems. We'll look at all the different stages of production and explore both time-honored animation principles and new digital tricks.

My personal 3D program of choice is Hash Animation:Master 99. However, the techniques I'll be suggesting won't rely on any program's particular toolset; they'll be applicable to all 3D animators. If I mention a particular Animation:Master feature, I'll do my best to point out the equivalent feature in other programs such as Softimage, Alias|Wavefront Maya, and NewTek LightWave.

The most important and creative aspect of animating a character has nothing to do with 3D. It's planning: using storyboards, pose reels, and exposure sheets to plan every movement before hitting your 3D animation program. With proper planning, not only will you eliminate the element of guesswork from animating a character, you'll nearly always come up with better ideas and a more polished final product. Without it, animating can become an excruciating exercise in trial and error.

This month's example comes from the beginning of *The Animator's Apprentice*, which features Dennis the Dog in the role of lowly intern to a CG wizard whose powers he appropriates on the sly. Dennis is lounging in an office chair. He scarfs down a dog cookie, then looks resentfully at another character offscreen. Let's look at the steps involved in planning the shot in preparation for animating it in a future column.

Three factors determine a character's performance: timing, posing, and shot composition. These variables work together to communicate the point of the shot and allow the audience to identify with the character. All three must be worked out in the planning stage.

The time-honored way to plan poses and shot compositions is to make a detailed storyboard. The initial storyboard can be very rough, sketched out quickly to get ideas down on paper, but any extra time you spend at this stage is well worth it, because these drawings will be used to plan the character's movement as well. You don't need to be a master illustrator—stick figures are adequate, and you can use arrows and movement lines to indicate movement in the shot.

The critical thing is to break down what happens in the shot and present each character so that its attitude and feelings are apparent. If you're tempted to create your storyboard panels within your 3D program, keep in mind that it's much quicker and easier to find a good pose on paper. Alternatively, if you're handy with a pen tablet, you can sketch into a 2D paint program such as Adobe Photoshop. The point is to maximize the flow of your ideas and minimize the amount of effort required to represent them.

What actions must Dennis perform in this sequence? He begins slumped in the chair in a pose that must clearly show an attitude of dejection. Then he reaches into his box of dog cookies and pulls one out, preparing to pop it in his mouth. Finally, he returns to his former position and looks resentfully offscreen. Four drawings were all it took to get the entire shot and its movement down on paper (Figure 1). I made more drawings as I tested different poses and compositions, but I threw most of them away.

Once you've worked out the poses and shot composition, it's time to think about timing. Without a doubt, timing is the hardest thing to get right about a character performance. If it's too slow, the animation will look as though it were shot underwater. If it's too fast, the actions go by so quickly that the audience will be confused. Good timing is always based on the artful combination of fast and slow movements. Fast movements catch the eye and build interest, but they must be bridged by slow, held poses to give each action a chance to sink in. As Disney animator Shamus Culhane puts it, "The poses tell the story, but it is the timing that intrigues the audience."

Timing is planned using a pose reel, often called an animatic. You can make a

CG Pear and Tangerines, with Grapes, by Jeremy A. Engleman

Real or REALimage®?

Artist Jeremy Engleman used 3D Studio MAX to create this incredible still life. Like other CG artists and designers, Jeremy is constantly pushing the limits of technology to produce more striking images.

"I'm trying to explore a painterly nature through CG media. This does not mean I am trying to make CG look like a painting through the use of 'art' filters, but rather I am trying to identify what can be painterly about computer graphics' own nature. The grain in the image above is the result of multiple conversions to indexed palettes."

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Rapid 3D #28

stencil maps are usually needed for each separately textured face. But even objects that don't have perpendicular surface normals can benefit, since the six textures can be blended together using the Blend Edges checkbox. The Stencil Shaderless Sides checkbox allows underlying textures to show through. Using this option, you could enhance a textured terrain with grassy areas applied only to polygons facing one direction.

UV Burner is the only ProShader that doesn't appear under the Resources palette. You call it either by clicking on a small icon on the button bar that runs across the top of the screen or by selecting it from the Modeling menu. It allows you to change the way a texture's coordinates are projected onto a polygon or mesh object. Once you've applied a texture, you select a mapping style from the Map pop-up dialog in the Object Properties dialog, and then click the UV button on the menu bar. For objects that have been imported or subjected to Boolean operations, this functionality can make the texture lie in a more realistic manner. Although it's useful, UV Burner is hampered somewhat by its trial-and-error nature (rendering is required to see the outcome) and also by the fact that the result can't be undone. Proceed with caution.

Modeling & Miscellany Displacement is a useful addition that works only on Bezier or mesh objects. This plug-in alters geometry according to a 2D image or video file, essentially translating pixel brightness into elevation. After launching the Displacement dialog, a map must be loaded to act as the source image. The dialog furnishes two sliders: sampling and maximum height. Sampling determines how many times the mesh object is subdivided. The default of zero uses an 8x8 grid to sample a Bezier patch; a setting of 100 samples the mesh in a 107x107 grid. Since higher numbers generate more information, use this dialog cautiously. The maximum height dialog sets the height of the brightest area, proportionately to the object's original size.

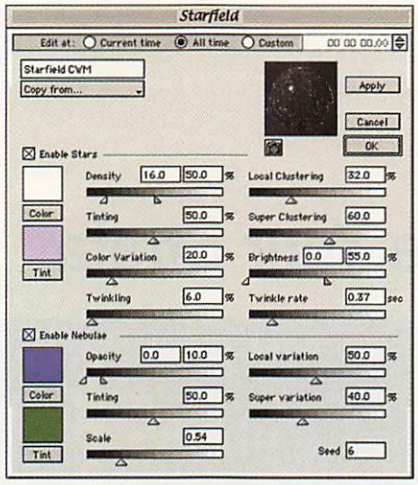

FIGURE 1. The Starfield dialog box. The other ProShaders dialog boxes are similar, with a preview tile in the top right corner and an assortment of sliders to adjust the shader's appearance.

Unlike the other plug-ins in the set, Displacement lets you preview the results before rendering. Since it affects object geometry directly, the results can be viewed in flat-shaded mode. As with all StudioPro textures, Displacement deformations can be animated to create unique effects, such as a curtain that flaps realistically in the wind.

The Corrosion plug-in imparts an appearance of age. It uses a bump map to create transparency, simulating holes and areas that have been etched away. The Corrosion shader must be placed over an existing texture and must appear at the top of the texture list in the Object Properties dialog. The bump map can't be changed, but a slew of parameters make it possible to customize the effect: invert bump, hole area, bump amplitude, resistant area, resistant bump, and random seed can be adjusted to create a realistically aged object in a fraction of the time it would take using conventional texture-mapping techniques.

The Wildlife plug-in defies categorization. It simulates the patterns of fur found on animals with spots. Five preset designs are included for animals such as giraffes, leopards, and cheetahs, and permutations of spots, spacing, irregularity, softness, and jaggedness can be mixed to create new ones. This texture can be applied to animal models, but it can also be used for clothes, rugs, upholstery, and the like.

Plenty & More A great deal of functionality resides in the ProShaders set. Some of the plug-ins are indispensible. In fact, Displacement and Corrosion deserve to be rolled into the main application. However, others are less handy—I have yet to find a use for Procedural Brick or Wildlife in a real-world project. Given the ascendancy of the Internet and the fact that all of the documentation is provided on the CD in PDF format, it would be more useful to distribute the individual plug-ins as Web downloads, so you can mix and match the ones you need.

On the other hand, the set is reasonably priced. To be honest, if I were to select individual plug-ins, I probably wouldn't choose Starfield, but I've gotten more mileage out of that one than any of the others. To my surprise, it's fantastic for creating animated textures to be composited with other rendered footage. So perhaps there are advantages to getting more than you think you need. Maybe you'll find uses other than those for which the plug-ins were designed.

Chris Manners is *3D*'s digital media manager and a speaker at the Digital Video Conference & Exposition.

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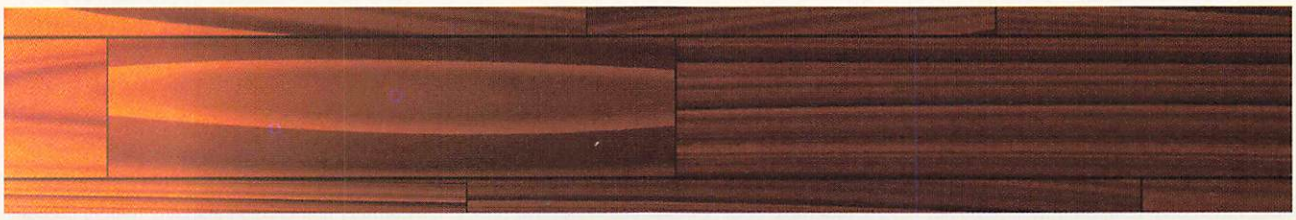

This is an example of the Procedural Plank component of ProShaders.

BY CHRIS MANNERS

Shade & Texture Your Strata

Strata StudioPro Power Module II: ProShaders

Power Module II: ProShaders ($149), Strata's second set of plug-ins to StudioPro 2.5 and higher, provides a series of nine extensions that, for the most part, provide advanced shading and texturing capabilities. Starfield and Moonscape simulate outer-space effects. Layered Rock and Procedural Brick help create stone surfaces. Blender and UV Burner supply advanced mapping capabilities. Of the remaining three, Displacement and Corrosion fall under a general heading of modeling, while Wildlife is somewhat esoteric.

After installation, all but UV Burner appear as presets in the Resource Palette (under the Textures tab) that can be applied directly to an object. The presets can be modified by double-clicking on the shader icon that appears in the top half of the Resource palette. In this scenario, a dialog opens that contains sliders for the adjustment for form, color, variation, and other parameters. It's also possible to create a shader from scratch by choosing New from the drop-down menu to the left of the Resource palette and selecting a shader type, which opens an editor dialog box.

Space Effects Moonscape generates irregularities such as those found on planets that have suffered impacts from asteroids. Variables control depth and height of irregularities, as well as quantity and scale. While it's possible to create similar surfaces via bump mapping, Moonscape makes it easier. The Starfield plug-in generates a starry night sky or a view from space. The two components to this extension, Starfield and Nebula, can be used independently or in conjunction. To create a space-like background, you'd use the Environment palette, place the Background tab at the forefront, and select Starfield from the drop-down menu. The resulting dialog box (Figure 1) offers checkboxes to enable both stars and nebulae. Controls for other ProShaders are presented via similar dialogs.

This illustration uses an excessive number of the plug-ins provided with Power Module II: ProShaders. The background has Starfield applied, and the planet has a Moonscape surface. The walls have been shaded with Layered Rock, and the right-hand surface has had the Corrosion plug-in applied. The sofa has a Wildlife texture and has been Displaced (together with the cushion) for a wrinkled effect. In addition, the metal drum has been Corroded, and the floor has been shaded with Procedural Brick.

The Starfield dialog is divided into two segments, one for each effect. Star variables include color variation, clustering, and twinkle rate (for animations). The nebula effect can be adjusted for color, scale, and local and super variation. Although they're obviously of limited utility, both effects can be applied to objects, as well as backgrounds and ground planes. More advanced texturing effects can be generated by either combining these textures with other shaders or animating them over time.

Bricks and Rocks In the real world, when rock has been subjected to eons of compression and pressure, it creates a stratified effect in which layers are squeezed together and distort. The Layered Rock plug-in simulates this effect to generate textures that resemble sedimentary rocks. The five presets can be altered easily by changing color swatches and adjusting pressure, turbulence, spacing, and layer size. The result is a wide variety of rock types that can be applied to either terrain meshes or objects.

In contrast, Procedural Brick creates a texture that's entirely fabricated: construction bricks with variable size, color, and degree of surface roughness. The most interesting variable is grooved mortar—width and depth settings add a realistic division between individual bricks. However, because the bricks are of uniform size, color, and bump, it's only useful for creating pristine new bricks. You can't vary brick size, inflict erosion, or grow moss, leaving the results far too uniform for general use.

Mapping Effects Blender lets you place up to six 2D textures on a single object. The positioning of the textures is determined by the direction in which the object's surface normals point. This capability makes Blender invaluable for texturing cubical objects such as boxes and buildings, since surfaces and

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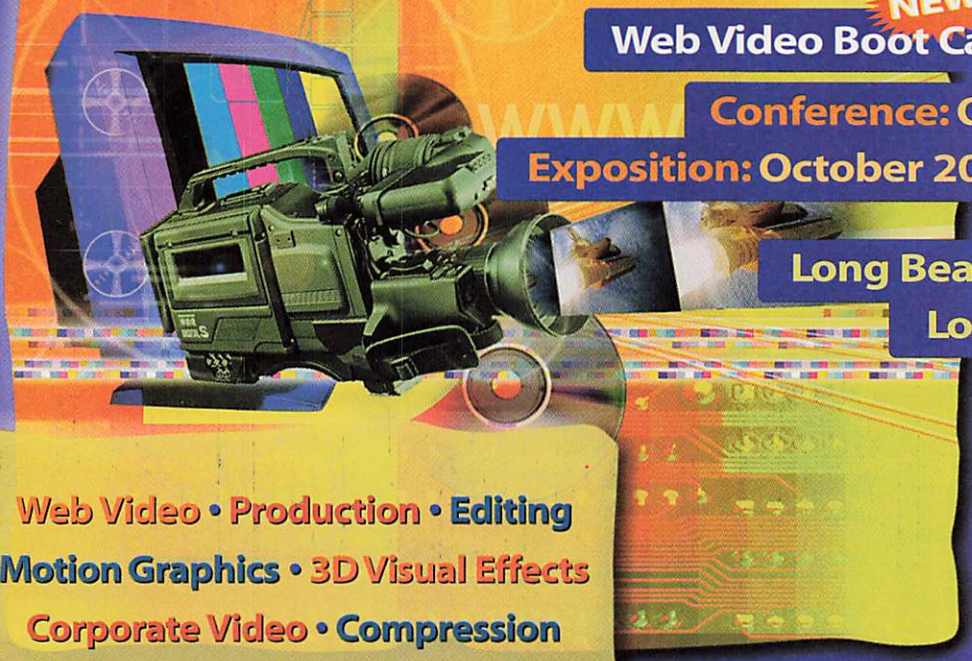

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Rapid 3D #25

FIGURE 4. PyroCluster clouds can emit their own illumination. There are no lights in this scene and ambient lighting is set to zero; the brick wall is illuminated solely by light cast from the flaming torch.

Afterburn and PyroCluster displayed the most realistic volumetric quality, evenly lit and suitably fogged from one side of the puff to the other. Those people who found PyroCluster lacking in its first incarnation should look again. The latest version is dramatically improved and, at the video resolutions I was rendering, I couldn't discern any real quality difference between the two. The price of this top-notch quality is somewhat longer rendering times.

UltraShock also performed acceptably but not without anomalies. As the camera passed the center of the puff where the particle itself was located, the view became distinctly darker and more dense, and it remained that way until the camera exited the edge of the puff. I wasn't able to determine the cause, but it appeared that the lighting being applied suddenly shifted to a referent that was in shadow. This happened with the single spotlight in the scene, so UltraShock users may need to pay extra attention to lighting.

Afterburn and UltraShock both delivered serviceable puffy clouds with their default settings. UltraShock and PyroCluster even have presets called Puffy Clouds—it doesn't get any easier than that!

Clouds in My Coffee Which is best? Unfortunately, there's no all-around, head-and-shoulders winner. Each has its own strengths, and if you do a lot of volumetric effects, you might have good uses for all three.

Afterburn does beautiful, fully volumetric dust, steam, clouds, and smoke. For large-format film work and anything else requiring the ultimate in quality, this may be your best bet. Beyond these uses, it's not as flexible as the other two.

PyroCluster is significantly more versatile right out of the box, with more control over light, shadow, and density. Its cloud rendering is on par with Afterburn's (at video resolutions, at least). Its unique architecture and additional features enable it to do effects such as self-illuminating vapors that would be more difficult, perhaps impossible, with either of the others. On the other hand, you'll probably have to spend more time getting the hang of it.

UltraShock's 2D tools are the most extensive, making it quicker for situations when the effect doesn't need to interact with the scene, but its output did exhibit some quirks. In the long run, it may prove the best investment due to its plug-in extensibility. However, no plug-ins to UltraShock are available as of this writing, and the plug-in architecture is not open, so you can't write your own shaders. UltraShock has been shown to work with Digimation Shag:Fur, which may be a plus for some users, and comes with built-in hooks to Pandora, Digimation's own particle system, which is available separately.

If I had to choose one and I wanted maximum versatility but didn't need cartoon effects, I would choose PyroCluster. It's fully integrated with Cebas' Pro Optics Suite tools and can be purchased separately or as part of Pro Optics Suite. If I did have cartoon work lined up and still wanted a lot of flexibility, UltraShock would probably be my choice, particularly if my wish list included some of the Video Post features.

Stephen C. Levy is a part-time animator, occasional writer, and full-time malcontent who resides in Los Angeles. His credits include 3D art direction on *The Simpsons Virtual Springfield* CD-ROM game.

over the lifetime of each particle. In nearly all cases, the settings are animatable over the lifetime of the effect, as well. This is done via the usual MAX method of turning on the Animate button, going to the desired frame, and changing the parameters.

I'm pleased to report that UltraShock and PyroCluster provide excellent previews that show how everything will look after it has been fully calculated. UltraShock's window will also do a full, miniature render of your whole scene, with all the bells and whistles. PyroCluster uses what appears to be a modified version of the standard MAX shaded viewport that renders atmospheric effects right in your viewport, in any view configuration. In contrast, Afterburn lets you preview the effect of this parameter and that setting, but you can't see the total result until you hit the Render button.

PyroCluster and UltraShock are both controlled through their helper objects on creation, and then through the Modify panel. One of UltraShock's unique features is its plug-in architecture—yes, plug-ins for a plug-in! That is, new features can be added without doing a full upgrade.

PyroCluster includes A-bomb, a unique particle system that creates perfect mushroom clouds with its default settings (Figure 3). It's a handy addition if you're interested in doing explosive effects. Another effect unique to PyroCluster is that its clouds can actually emit their own illumination (Figure 4).

Complex Effects Using PyroCluster, each particle system gets its own helper object, which is automatically assigned at creation time. If you change your mind later, a helper object can be unlinked and relinked with the normal MAX hierarchical attachment buttons. If you have more than one PyroCluster effect in a scene, coordination between them is handled through a clever system of parameter sharing. You can decide, on the fly, which parameter values are shared among the PyroCluster effects.

Sharing parameters among effects is easy to accomplish. Each parameter or set of parameters has a pin, like the standard MAX modifier stack pin. If the pin is down, that parameter becomes part of the shared group. Only the other helper objects with their pin down for a given parameter are affected; helper objects whose pins remain up stay independent. Parameter sharing,

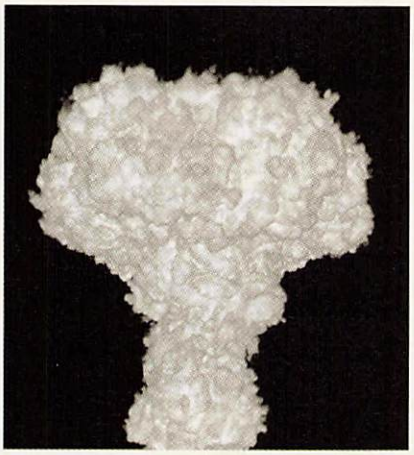

FIGURE 3. PyroCluster's A-bomb particle system creates perfect mushroom clouds with its default settings.

unique to PyroCluster, can be a great help when multiple effects are active in the scene.

Afterburn and UltraShock don't really address this issue of similar, but not quite the same, effects. Cloning becomes an all-or-nothing affair, but since the underlying particle systems themselves may be wildly different, in some cases it may not be a problem. In other instances, though, PyroCluster's capability can eliminate much clicking and scrolling.

Test Results To test the volumetric properties of each plug-in, I set up a simple scene: one puff and a camera animated to pass through the volume occupied by that puff, one spotlight, and a cube to receive shadows. I rendered 100 frames of each setup and kept track of the time, first with no shadows, then with mapped shadows, and finally with raytraced shadows.

I had hoped to report rendering times for these flythroughs, but in my quest to arrive at parameters that would yield similar-appearing clouds, I found that render times could vary widely for very similar effects. I could create acceptable clouds that rendered quickly with all three, and I could also turn each render into an hours-per-frame ordeal. Moreover, my own spinner-twiddling skills seemed to play a large part in the render times. Thus, your mileage may vary.

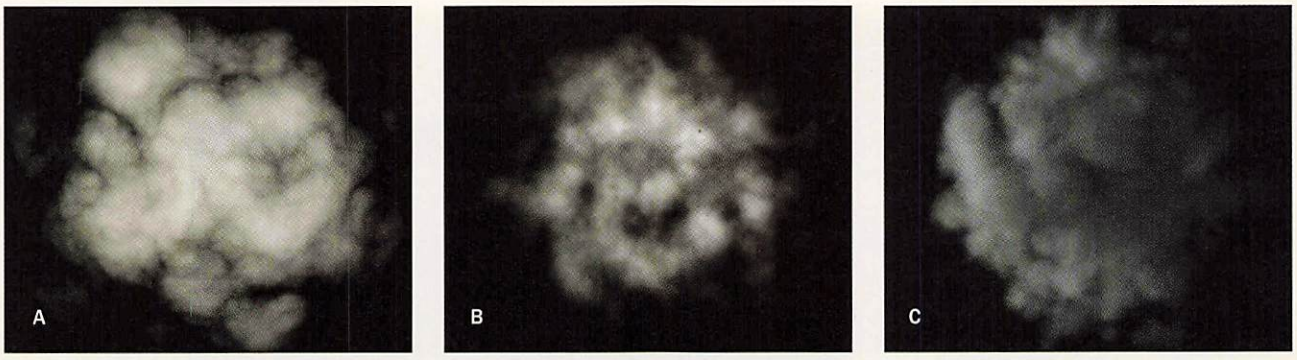

FIGURE 2. One volumetric puff, rendered using Afterburn (a), PyroCluster (b), and UltraShock (c). I tried to get a similar effect from each, though I spared myself the hair-pulling that would result from trying to make the match more exact.

through multiple entries in the Effects pane, though each Environment entry can act upon more than one particle system. You must also select which lights the Afterburn system sees for its self-shadowing and shadow-casting effects. Afterburn doesn't do mapped shadows. Pick your jaw up off the ground, and I'll explain. Two rendering options are provided for regular Afterburn effects, called RayMarcher and Octane Shader. Neither sees mapped shadows—both use the raytraced shadows setting, although the result of using the Octane Shader is rendering times in line with what you'd expect using mapped shadows. RayMarcher delivers actual raytraced shadows, with rendering times to match.

PyroCluster is implemented as a helper object assigned to the associated particle systems. The particle system is linked, through the helper object, to entries in the Environment panel. In PyroCluster's case, there are no variables in the Environment entry; the values stored in the helper object are called from the Environment. PyroCluster has a slightly steeper learning curve before you can get started due to the number of parameters it gives you to play with. (On the other hand, it comes with the most sample files from which to cut and paste settings.) Once I got used to it, though, I began to see its merits, especially compared with the load-a-piece, call-a-function workflow of the other two. Even PyroCluster's Environment entry is automatically placed and activated when you put a PyroCluster helper object in your scene.

UltraShock's helper object, which looks like a space warp, can be assigned more than one particle system so each shares all UltraShock settings. Alternatively, multiple helper objects with different parameters can control their own systems. Particle systems and lights are selected by click-to-pick or select-by-name. Like Afterburn, UltraShock requires its own special versions of MAX's usual lights for some capabilities. UltraShock uses its Environment entries to control shadowing functions. Afterburn and UltraShock also include cartoon rendering effects, which PyroCluster doesn't.

Each lets you save and load preset effects, and each ships with sample files to help get you started. In addition, both PyroCluster and UltraShock offer preset configurations of the plug-in user interface itself, making for quick and easy setups. PyroCluster has six buttons for common uses, while UltraShock's plug-in architecture allows each feature to be, in effect, its own preset.

User Interfaces The good thing about all three user interfaces is that practically everything is independently controllable and animatable. The downside is that this makes for a great deal of spinners to twiddle.

Afterburn is different insofar as its user interface is completely within the Environment dialog, where five separate elements can be mixed and matched to fit your needs. Afterburn itself handles volumetric effects. AB Combustion, AB Volume Fog, and AB Volume Light account for the next three. These are the same as the standard MAX versions, but they're Afterburn-aware, which is necessary to avoid unwanted side effects when you use these native effects with Afterburn. The fifth element is AB Renderer, which goes in last and must be present to create the Afterburn effects. This renderer, like PyroCluster's Environment entry, has no separate parameters—it just exists to call those functions. Once you've placed an AB entry in the window, its dialog pops up, presenting panes that govern all aspects of the effect.

If you like the way MAX panes pop into view when you open them, you may be mildly dismayed by UltraShock's plug-in loading behavior. The panes just won't pop up, and you can't even right-click on the panel to bring them up. Panning down manually is the only way to get at them.

One of Afterburn's best features is Animation Flow Curves, which provide spline-based control over nearly all parameters. Just click on the AFC button for a given parameter, and a window, similar in size and operation to the standard Loft Deformation windows, opens up to provide complete control.

UltraShock doesn't allow for quite this much flexibility, allowing only a start value, an end value, and control over the interpolation, but no way to set intermediate values directly. PyroCluster allows complete control of many parameters via a range bar system that features an unlimited number of control points with either linear or adjustable in and out handles. Other attributes allow only a start and an end value.

It's important to note that these parameter controls vary the settings of the effect

sources

Afterburn 1.0 · list price $345
Aftershock/Lumens · RAPID 3D NO. 152
distributed by ID8 Media and Digimation (including R3)
Plugs into 3D Studio MAX, R3 compatible

PyroCluster 1.7 · list price $345
Cebas Computer Inc. · RAPID 3D NO. 153
distributed in the U.S. by Trinity3D
Plugs into 3D Studio MAX, R3 compatible

UltraShock 1.1d · list price $295
Digimation · RAPID 3D NO. 154
distributed by Digimation
Plugs into 3D Studio MAX 2, R3 compatibility in progress

BY STEPHEN C. LEVY

Something in the Air

Afterworks/Lumens Afterburn, Cebas PyroCluster, and Digimation UltraShock

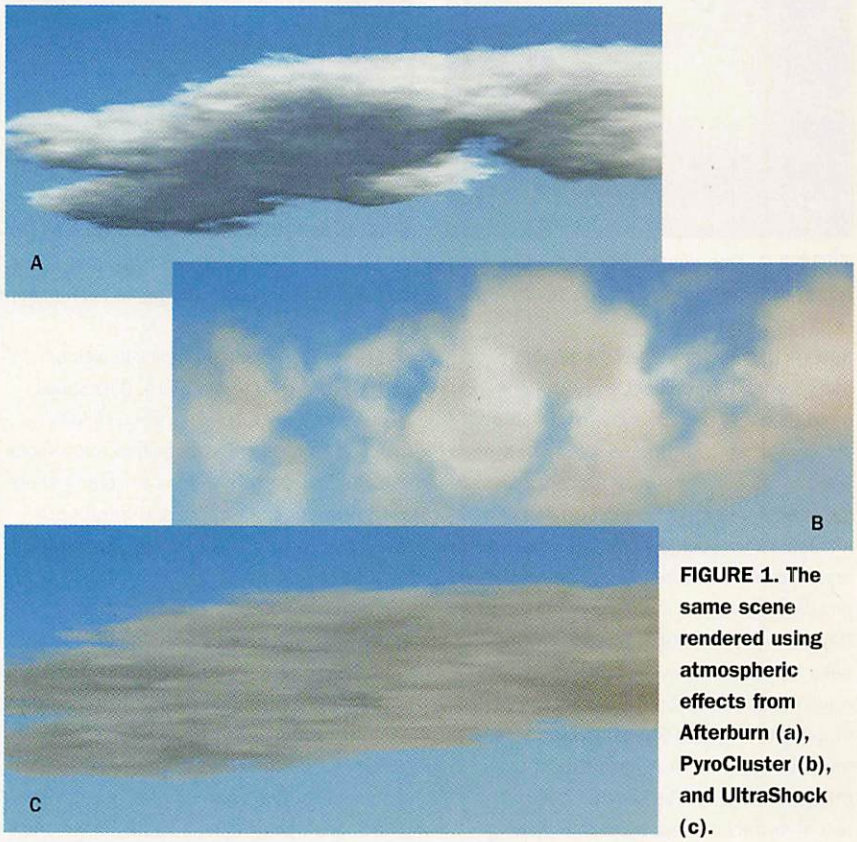

FIGURE 1. The same scene rendered using atmospheric effects from Afterburn (a), PyroCluster (b), and UltraShock (c).

In the beginning (five years ago, anyway), there was Vapor, a Yost Group add-on to Autodesk 3D Studio 3 for DOS. And the animators saw that Vapor was good. But Vapor was not truly volumetric, which made the animators sad.

Soon, a new name was heard in the land, and that name was MAX. And MAX had Combustion. "At last, a true volumetric!" cried the animators. And they were glad, for now they could create vaporous objects in three-dimensional space. Then, as animators will, they longed for more and became sad again.

And it came to pass that the cries of the animators were heard by three companies of wise programmers. Each sent a champion to enable MAX users to create volumetric effects of varying form and density, from a wisp of dust to the blackest smoke cloud. And their names were Afterworks/Lumens, Cebas, and Digimation.

Honors for the first shipping volumetric plug-in for MAX go to Cebas PyroCluster, now in version 1.7. Although Digimation UltraShock was actually first to ship, version 1.0 simulated volumetric effects in a 2D Video Post layer, a capability that persists in current version 1.1d, though it's now augmented by true volumetrics. Meanwhile, the spring 1998 release of Afterworks/Lumens Afterburn, although it was offered for sale, was a beta version. That didn't stop it from being used in a certain big-budget, big-star Hollywood meteorite movie last summer, though, and now it's in version 1.0. It wasn't until the end of September 1998 that all three were available complete with manuals, samples, and help files.

All three were stable on my system, running MAX 2.5 on Windows NT 4 with Service Pack 3. Afterburn and PyroCluster are compatible with MAX 3, and a MAX 3 update of UltraShock is in progress as of this writing.

When planning this review, I envisioned an old-fashioned shootout. Put all three in the ring together, no holds barred, until one emerged the winner. Unfortunately, the plug-ins themselves didn't want to go along with my plan. Although all three are intended to do the same types of effects, I found it difficult to get results similar enough to directly compare (Figure 1). Even when the spinners had the same label, Noise Size, for example, the numbers in the window didn't correlate. A Noise Size of 8 might be a high value in one, a small value in another.

Setup All three use a particle system, either standard or third-party, to determine when and where an effect will be placed in the scene. They each render a volumetric puff around each particle in the assigned system, which is highly controllable, though it can't quite be sculpted (Figure 2). Moreover, each plug-in boasts several panes of fully animatable parameters, letting you define the attributes of each puff in great detail, and you can preview the results. But that's where the similarities end.

PyroCluster also offers Video Post functionality through a checkbox in its user interface and additional controls over Video Post rendering parameters. In its current version, Afterburn limits its Video Post presence to Glow controls. UltraShock, as befits its origins, has a major Video Post presence for its previously mentioned bag of 2D tricks.

Why talk about Video Post when these are supposed to be volumetric plug-ins? In cases where the effect doesn't need to interact with the rest of the scene, using a Video Post-rendered version can reduce render time drastically compared to a 3D effect. In many of these cases, it can be difficult to tell the difference, so why not save rendering time? As you will see, rendering time can become a real concern.

Afterburn's primary dialog is accessed through the Environment window, making it modeless. Different effects are handled

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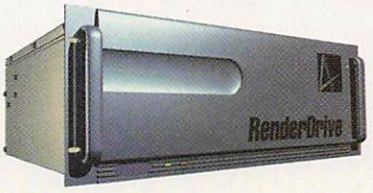

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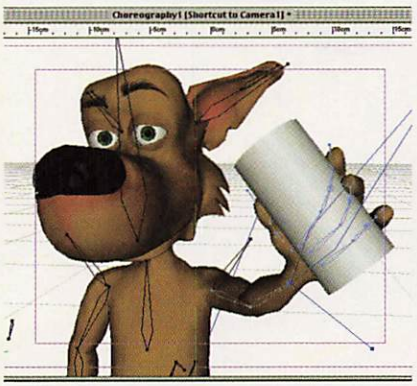

FIGURE 4. Animation:Master's new Compensate mode allows characters to grip and handle objects with amazing ease.

FIGURE 5. This landscape was rendered in Animation:Master by Brian Prince. He used Hash procedurals to create the rock, dirt, grass, and sky surfaces.

thin objects or high-contrast edges. An oversampling option has been added in 7.1 to deal with this. Depth of field, fog, film grain, raytraced reflection/refraction, and field rendering are all supported, as is a toon shader.

One area where the renderer falls short is motion blur. The motion-blur method in 7.1 is extremely fast (it only adds a few seconds to rendering time) and looks good under most circumstances, but it only blurs backwards from the current position of the object. This is a big improvement over the motion blur in previous versions, but the feature needs more work. (As a workaround, render with a 360° motion blur and shift all keyframes 0.5 frame ahead. This produces essentially the same effect as the 180° blurs behind and ahead of an object that appear on normal film and in most renderers). The network version of Animation:Master includes an alternate multipass motion-blur rendering technique, which is completely accurate but adds substantially to render time.

Network rendering has long been available for Animation:Master through a $699 version of the package on the PC. With 7.1, Hash has finally released a version of Netrender for the Mac, though not in time to test for this review. The same batch and network rendering features are available for both platforms, and net rendering can now take place across a hybrid network.

Hash has not actively encouraged growth of a plug-in market for Animation:Master. The only third-party commercial plug-in available is DarkTree Symbiont, a procedural texture plug-in that works with the standalone DarkTree texture generator (from Darkling Simulations, www.darksim.com, PC only). Additional Animation:Master plug-in support is limited to procedural texture plug-ins (it will take any Imagine ATX texture) and export plug-ins such as the OBJ and DirectX exporters, which, along with others, are available at www.hash.com/users/jsherwood. The Animation:Master export SDK is available at ftp://ftp.hash.com/pub/misc/amsdk.exe.

With its strong spline modeler, top-notch IK and constraints, and system of reusable and blendable Actions, Animation:Master offers sophisticated and powerful character animation tools at a remarkable price. In my opinion, there's no comparable program under $5,000. At $199, Animation:Master has to be the best animation deal in town.

Raf Anzovin is the co-founder of Anzovin Studio, based in Amherst, MA. A trailer for his upcoming film, *The Animator's Apprentice*, can be viewed at www.anzovin.com/films/apprentice.

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modes and tools can't handle. A feature called Smart Skin takes care of many joint and muscle-flexing problems by allowing precise deformations to be constrained directly to the rotation of a bone.

The new Compensate mode takes the guesswork out of animating characters who touch their surroundings, pick up objects, push things around, or otherwise act on their environments and each other (Figure 4). Using Compensate mode in conjunction with constraints, you can quickly attach and detach bones on any given frame—even to the point of reworking the parenting hierarchy, if necessary—in a seamless way that doesn't disturb the animation workflow and force you to think about setup instead of animating. You could, for instance, attach a cup object to a character's hand on the frame in which it grasps the cup, without disturbing the cup's position, with only three mouse clicks. Or you could attach the tips of the fingers to given spots on the surface of the cup handle with equal ease, allowing the cup to move around in the character's hand without the fingers losing their grip or going through parts of the cup. When you want the character to release the cup on a given frame, all these constraints can be undone—leaving the cup wherever the character has put it down. With practice, character interaction becomes as seamless and second-nature as moving objects around in the real world.

Animation:Master also provides the advantage of reusable motions. Character motions are organized into self-contained "Action" files. There are two kinds of actions: Actions and Choreography Actions. Choreography Actions can be used to animate within the scene (called the Choreography in Hashspeak) in which a character is placed. The other type of Action is completely separate from the scene in which it is used, and can be dragged and dropped onto a character in any Choreography or onto any other characters with the same bone structure.

Moreover, Actions can be layered together using additive or blended modes. An Action can override another on a selected set of bones or blend with it by an animatable percentage. The values of two Actions can also be added together, so that Action 2 adds to the rotational and positional values of the bones influenced by Action 1. New in version 7.1 is the ability to turn a Choreography Action into an Action, and the ability to "bake" several Actions together into one.

You can certainly animate a character using standard pose-to-pose keyframe methods, as in most other programs, but the Action system of motion lends itself well to more sophisticated techniques. To layer a character's motion, create the basic body choreography, save that in an Action, then use the Add mode to animate secondary and overlapping Actions on top in the Choreography. Or one Action layer can hold lip sync, and another can add facial expression on top of the basic lip movements, allowing them to be controlled separately. Building a basic library of Actions for a character—eye blinks, hand gestures, commonly used expressions—can speed up animation immensely, especially since the Add mode can be used to ensure that even reused Actions never come out looking exactly the same in different scenes.

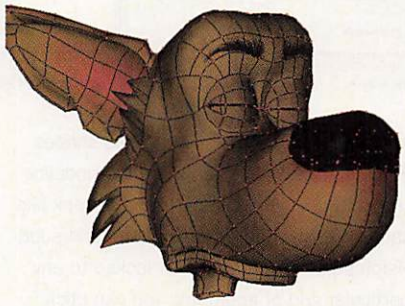

FIGURE 3. When stitched together correctly, Hash patches can be used to model very organic shapes.

Another useful tool is the Pose Slider window. Pose Sliders allow any animatable attribute—bone movement and rotation, control-point movement, and even constraint percentages—to be controlled by a simple slider. Sliders can be set to clench a fist, raise an eyebrow, or curl a lip. A complex character can have hundreds of pose sliders to control every aspect of motion. To edit animation data, Animation:Master uses both a simplified timeline that shows all the moving tracks in an action at once and function-curve editing tools, which appear in a separate window. Any number of function curves from different attributes can be opened in the same window and edited at once.

Animation:Master offers the usual image-mapping geometries, including planar, cylindrical, and spherical. In addition, image maps can be applied using an unusual method called "decals." Decals simply apply an image to whatever patches the viewer is currently looking at, from whatever view is currently active (including cameras and lights). Because decals are sensitive to which patches are visible to the user, they don't do counter-intuitive things like apply to the insides and backs of objects, and they're much easier to use than most implementations of UV mapping. A decal can hold more than one image and be stamped in more than one area on an object. In 7.1, a new method called "patch images" applies an image to each patch fully. This can be useful for creating repeating patterns.

Image maps aside, Animation:Master can do quite a lot using only its procedural texture generator (Figure 5). It uses a number of procedural "combiners" to blend two different texture attributes. Attributes can be colors, or they can be complex ATX texture plug-ins. (Animation:Master includes several, including stone crack generators, planet surface generators, and even a basketball surface generator.) Combiners include gradients and several kinds of fractal noise. It's possible to create anisotropic surfaces that react to light differently depending on the angle of view. Currently, the biggest limitation on procedural textures in Animation:Master is that combiners can't be used to generate bump maps. That's unfortunate, because the fractal noise generator would be well-suited to just such a use.

Animation:Master's renderer has undergone considerable improvement since version 5. It can easily handle high resolutions and high-res texture maps (with adequate RAM, of course), and the rendering is generally high quality and reasonably fast. A 1000 x 562 render of a complex character with 2,000 patches, several 2K image maps, and large shadow maps took less than a minute on the G3. Hash uses an unusual form of anti-aliasing that is fast but leaves jaggies on

sources

Animation:Master 99 7.1
list price $199; $699 network version
Hash Inc. · RAPID 3D NO. 155

SYSTEM REQUIREMENTS:
•Macintosh: PowerMac, OS 7.5 or greater; 24MB RAM; CD-ROM drive.

•Windows: Pentium, Windows 95/98/NT 4; 24MB RAM; CD-ROM drive.

BY RAF ANZOVIN

Animation Power on the Cheap

Hash Animation:Master 99 version 7.1

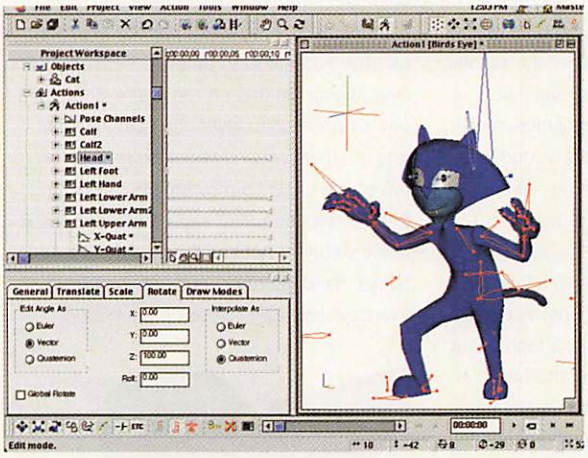

FIGURE 1. Animation:Master is controlled almost entirely by two floaters: the Project Workspace (upper left) and the Properties Panel (lower left), plus a number of toolbars. You can edit animation data as function curves or in a timeline format.

Animators agree that character animation is probably the hardest thing you can do in 3D. That's not just because character animation is inherently difficult; it's also because many 3D apps fight you every step of the way with tools that tend to make your task harder, not easier. Hash Animation:Master 99 7.1 (Hash Inc. uses both year and version number to denote its products) is one of the few programs written purely for character animation, and I think it's as close to a character animator's dream as any current commercial package. The Animation:Master development cycle is also exceedingly fast; two major revisions were already released this year, and another major update is likely to arrive before year's end. The latest, version 7.1, features speed increases, new rendering features, and a number of new animation tools.

I tested Animation:Master on an Apple Macintosh beige G3, overclocked to 466MHz, with 288MB of RAM, an ATI Nexus GA 8MB video card, and Mac OS 8.5. While Animation:Master, like all 3D programs, wants to have the most resources possible, it runs fine on slower machines. It can be used successfully on a Pentium 133 with 90MB of RAM, and it isn't even ridiculously slow.

Animation:Master's stripped-down interface puts all the necessary tools within easy reach and then gets out of the way (Figure 1). Hash has mostly resisted an urge that afflicts many 3D developers: to hide tools away in complicated nested windows or menus. Almost the entire Animation:Master interface can be controlled from two floaters and a set of toolbars. A handy context-sensitive menu can be popped up anywhere, and keyboard equivalents are easily customized.

One of Animation:Master's main selling points is its unusual spline modeling tools, which rely on proprietary Hash splines. (There is no polygonal modeling in Animation:Master.) Hash splines lend themselves to the creation of complex organic shapes and are especially appropriate for modeling characters. Hash splines (Figure 2) look like cardinal splines, but like polygons and subdivision surfaces, they are not locked to any particular grid or geometry. You can stick Hash patches up against each other in any formation, and if the surface follows certain Hash-specific rules, it will render fine (Figure 3). "Hooks" are used to attach a control point to the middle of another spline, which is useful for increasing and decreasing the level of detail in a model. A special-case patch that's bounded by five points instead of three or four allows difficult branching areas such as shoulders and hips to be closed without producing creases.

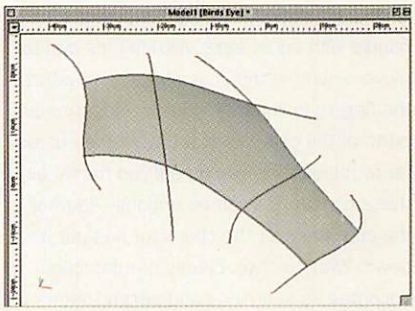

FIGURE 2. Hash patches look a little like cardinal splines, but they handle more like polygons or subdivision surfaces. Notice that the patch in the middle is a five-point patch, a special-case patch that is useful for constructing complex but seamless geometry.

That said, Animation:Master's modeler conspicuously lacks higher-level modeling tools. There are no lofting, beveling, or skinning features—each surface must be built up spline by spline with the help of lathes and basic extrusions. Nor are there tools for manipulating large groups of points, such as magnet tools or a deformation lattice. Animation:Master is therefore not the app of choice for modeling complex architectural or mechanical forms. The program does include a DXF parser that will take quad-only DXF files from other programs and turn them into Hash spline models, usually without the need for significant cleanup. Many Animation:Master users also turn to freeware Hash modeling utilities that do lofting, height extrusion, and other tasks not available in the software itself. (You can find these, plus many Animation:Master tutorials, at www.hash.com/users/jsherwood.) Still, the lack of deformation tools makes certain jobs difficult. Hash promises a lattice deformer in a future release.

Animation:Master's rigging and animation tools are the program's crown jewels. The constraint/IK system, which relates the movement of many bones to each other (see "Dem Bones," by Raf Anzovin, June 1999), is idiosyncratic but provides a fast and intuitive way toward the desired end. Expressions are not yet available, but there are very few tasks Animation:Master's existing constraint

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- 128MB memory, Maximum 1GB
- 20GB Ultra DMA System Drive
- 32X CD ROM, Sound Card and Speakers
- 21" Iiyama Monitor, 1800x1440, 110KHz
- Windows NT 4.0

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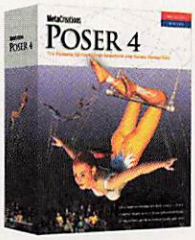

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Rapid 3D #17

these purposes, the K7 is worth a look. And considering that prices are as low as $699 per 600MHz processor in quantities of 1,000, I look forward to further escalation in the price wars and consequently more power for less dinero.

Pick Your Poison I was blown away by the Intergraph's 3D performance. The Mac made me want to ditch Windows altogether. The AMD surprised the heck out of me, in a good way. I can't recommend one platform over the other two without qualification. There are so many combinations of tools, tasks, and needs out there that each of these systems is bound to suit one of them best.

Obviously, if you use Alias|Wavefront Maya and 3D is your primary focus, you'd find a G3 useless. If you do lots of 3D, web, and print work, a Mac may be a perfect fit, and it will perform better across the CG spectrum than a box running Windows. If you're looking for cheap, raw power, an AMD-based solution is a worthy contender. That no single platform can satisfy all 3D and computer graphics users is evident if you look around the larger facilities. Usually you'll find a slew of different machines, Mac, PC, and UNIX.

Personally, if apps like Maya were on the Mac platform, I'd probably ditch Windows altogether. The Intergraph, on the other hand, makes even a crappy OS nice to use, and the raw rendering and interactivity of this beast can't be beat. Additionally, given the per-CPU costs, I see no reason not to use a bunch of AMDs as a render farm. If I were on a limited budget, I'd definitely consider a K7 box for my main workstation needs.

All three boxes examined here proved to be capable content creation machines, and one will fit your needs, personality, and pocketbook better than others. But that's a choice only you can make. Set processors to render!

Chris Tome is technical editor for *3D*. Email him at ctome@mfi.com.

cool tools for the test bench

As I tested the Apple G3 400, Intergraph TDZ 2000 GX1, and AMD K7 600 Athlon, I was aided by a number of incidental tools. Some were software utilities. Others were hardware peripherals. What follows doesn't constitute a set of comprehensive reviews, but I would like to give credit where it's due. Each of these tools earned my strong recommendation.

First, tools for the Mac. The G3's hard disk caused me trouble, but I managed to fix it using FWB Hard Disk Toolkit. The Toolkit is an excellent disk management and maintenance suite, and every Mac user should own a copy. The Tech Tools software enables you to check your Mac's system status in much more detail than the standard system tools allow. (www.fwb.com)

For the PC, I found Executive Software Diskeeper Lite, thanks to Peter Sheerin, tech editor for *Cadence* magazine. The free software displays a detailed graph of your drive's status, defragments it, and tells you how many fragmented files and excess fragments it cleaned. The commercial version does this as you work, running in the background. (www.diskeeper.com)

The Epson 900 printer proved a great asset. It has parallel, serial, and USB connections, comes with PC and Mac software, and makes amazing color prints. The unit's 1440dpi interpolated resolution is stunning, and if you print on photo gloss paper, you get, that's right, photo quality. With the addition of inkjet transfer paper from Wyndstone Papers, you can also make high-quality T-shirts. Using Photoshop 5.0 and the Epson color profiles, I was able to get perfect color on the G3 and good color on the AMD.

After borrowing a friend's Sony Mini-DV PCR-7 camera, I hooked it up to the Mac's FireWire port, launched Digital Origin EditDV and MotoDV software, and Shazam! The Mac and camera introduced themselves and kicked off a plug-and-play joyfest. It was easy to capture the Mini-DV footage and bring it into EditDV, which is a competent, albeit somewhat limited, video editing package; Adobe After Effects, Adobe Premiere, or Apple Final Cut Pro might be better suited to professional video. The cost of entry is well worth the price, and anyone with a FireWire card and a taste for video would do well to check it out. A FireWire card for older beige G3s is also available. Get more info at www.digitalorigin.com.

For video pros and/or 3D artists who need a roomy data storage facility, the Medea VideoRAID is a fast performer, clocking in better than 36MBps. It's also a good value, at just under $40 per gigabyte. I used the 100GB version, and it was smooth sailing (disregarding a time-consuming problem with the G3's drive and a firmware update later using a PC to update the drive). (www.medea.com)

A quirk of my operation is that I always have new machines to load the same old apps on to. Although CD-R decks are very helpful for accomplishing this, I prefer the convenience of Iomega Jaz and Zip drives. The new Jaz IIs and Zip 250s are great. They've given me no problems whatsoever, even with older media such as 1GB Jaz carts and 100MB Zip disks. SneakerNet can provide better security and data integrity than any real network. Like the Syquest drives from days of yore, Iomega drives are ubiquitous—for now—and if you travel with your files, you need one or both. (www.iomega.com)

Testing With LightWave

To run the LightWave tests of OpenGL interactivity, first you need to load the lw_timer.p plug-in for your platform. You'll find it at the *3D* web site, www.3dgate.com. After you launch LightWave and load the plug-in into Layout, load the mechwalk.lws scene file (a healthy scene at 19,972 polys) and select a part of the robot. Then hit M for the Motion Graph and, under Motion plug-ins, hit Add. Go to Options and click Enable, then choose Use Motion. Play the file in an OpenGL window, making sure your polygon threshold in the Layout View panel under the Options tab is set to at least 1/3 more polys than are in the scene (in this case, roughly 30,000). After the scene file has played through, stop it, go back into the plug-ins panel in the Motion panel, and click on Options, where you can write the results to a text file. The text file records an average frame rate in milliseconds for the entire scene. Repeat these steps (with the exception of loading the plug-in) with the hummer.lws file, and you can run the tests on your own machine.

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Rapid 3D #16

	Intergraph TDZ 2000 GX1 dual Xeon 550	Apple Power Macintosh G3	AMD K7 600Mhz White Box
CPU	Dual PIII Xeon 550s	400MHz G3 PowerPC	600MHz AMD Athlon
CACHE	2MB L2 Backside Cache ea.	1MB L2 Backside Cache	512kB L2 Backside Cache
DISK	9GB Ultra 2 SCSI 10,000 rpm	9GB Ultra 2 SCSI 7,200 rpm	18GB IDE 7,200 rpm
RAM	512MB SDRAM	512MB DIMMS	512MB DIMMS
GRAPHICS CARD	Intense 3D Wildcat 4105 (16MB frame, 64MB texture)	ATI Rage 128 (16MB SDRAM)	nVidia Riva TNT 2 Ultra (32MB RAM)
AGP SLOT(S)	1	N/A	1
OTHER SLOTS	5 PCI, 1 PCI/ISA	4 PCI	4 PCI, 3 ISA
OTHER PORTS	2 serial, 1 parallel	N/A	2 serial, 1 parallel
CD-ROM	40X E-IDE	32X E-IDE CD-ROM, 5X DVD-ROM	40X CD-ROM, 6X DVD-ROM
USB	2	2	2
FireWire (IEEE 1394)	N/A	1	0
Sound	64-bit stereo sound card	16 bit stereo sound	64 bit Sound Blaster compatible
LW TIMER TESTS			
Mechwalk.lws (in milliseconds)	58.9ms	146.0ms	76.24ms
Hummer.lws (in milliseconds)	280.9ms	wouldn't run	382.9ms
RENDERING TESTS (prev. on)			
Raytrace.lws	04:30.56 dual / 07:32.39 single	08:52.56 single	07:45.02 single
DOF.lws	00:32.40 dual / 00:38.90 single	00:37.67 single	00:23.48 single
Textures.lws	00:12.46 dual / 00:18.45 single	00:42.44 single	00:13.09 single
Zbuffsort.lws	00:23.41 dual / 00:45.56 single	00:48.72 single	00:26.40 single
RENDERING TESTS (prev. off)			
Raytrace.lws	04:30.08 dual / 07:26.72 single	08:10.22 single	07:36.44 single
DOF.lws	00:27.34 dual / 00:30.05 single	00:37.49 single	00:21.05 single
Textures.lws	00:11.59 dual / 00:15.53 single	00:14.52 single	00:12.21 single
Zbuffsort.lws	00:22.99 dual / 00:45.37 single	00:44.82 single	00:23.55 single
GLAZE (1024X768X32)	74.8fps	N/A	81fps
LightScape Viewer (2rooms.lvs)	15.13fps / 120,982 polys	N/A	7.6fps / 120,982 polys
WinBench 99 CPUMark	45.8 single processor	N/A	57.3
WinBench 99 FPUMark	2830 single processor	N/A	3280
MacBench 99	N/A	CPU = 1304 (G3 300 = 1000)	N/A
Cinema4D test (level is P133)	SP: 5.69 / MP: 10.56	SP: 5.37	SP: 8.03 / MP: n/a
Cinema4D test OpenGL 3D	428,902 triangles/sec	217,660 triangles/sec	354,426 triangles/sec
Cost	$8,569 (w/o monitor)	$4,519 (w/o monitor)	$2,500 w/o monitor (approx.)
Warranty	1 yr onsite / 3 yr parts/labor	1 yr parts/labor ($180 for 3 yr)	N/A

I hit the reset button and it snapped right off. If a clone is all you can afford, make sure to get the highest quality parts, power supply, and case your pocketbook will allow.

The case, however, was secondary to my real concern: to determine whether an AMD processor could hold its own against an Intel, both in reliability and performance.

Boy, did it ever. Initially, I had some problems with NT, but they were setup issues with the hard disk. Once I had beaten the NT monster (a fight that was neither short nor pleasant), testing proceeded without incident. The K7's 3DNow! architecture, which is similar to the Katmai instructions on Pentium IIIs, can greatly improve performance, especially in the areas of multimedia and 3D. While 3DNow! support isn't currently as strong as Katmai support on Pentiums, many app developers have expressed their commitment to coding for the 3DNow! registers. It will be interesting to see who supports them.

Running real-world and benchmark tests, the K7 performed admirably. Except for a few weird events over the course of a few weeks, the AMD performed like a true champ. For the record, all three machines I looked at exhibited quirks now and then. I've never encountered a box I couldn't crash, at least not one I put through torture testing. After all, we're not playing video games—we're making games, not to mention movies, TV shows, commercials, architectural flythroughs, industrial designs, VR installations, and other high-end content. 3D artists and animators are the power users of the computer industry. For

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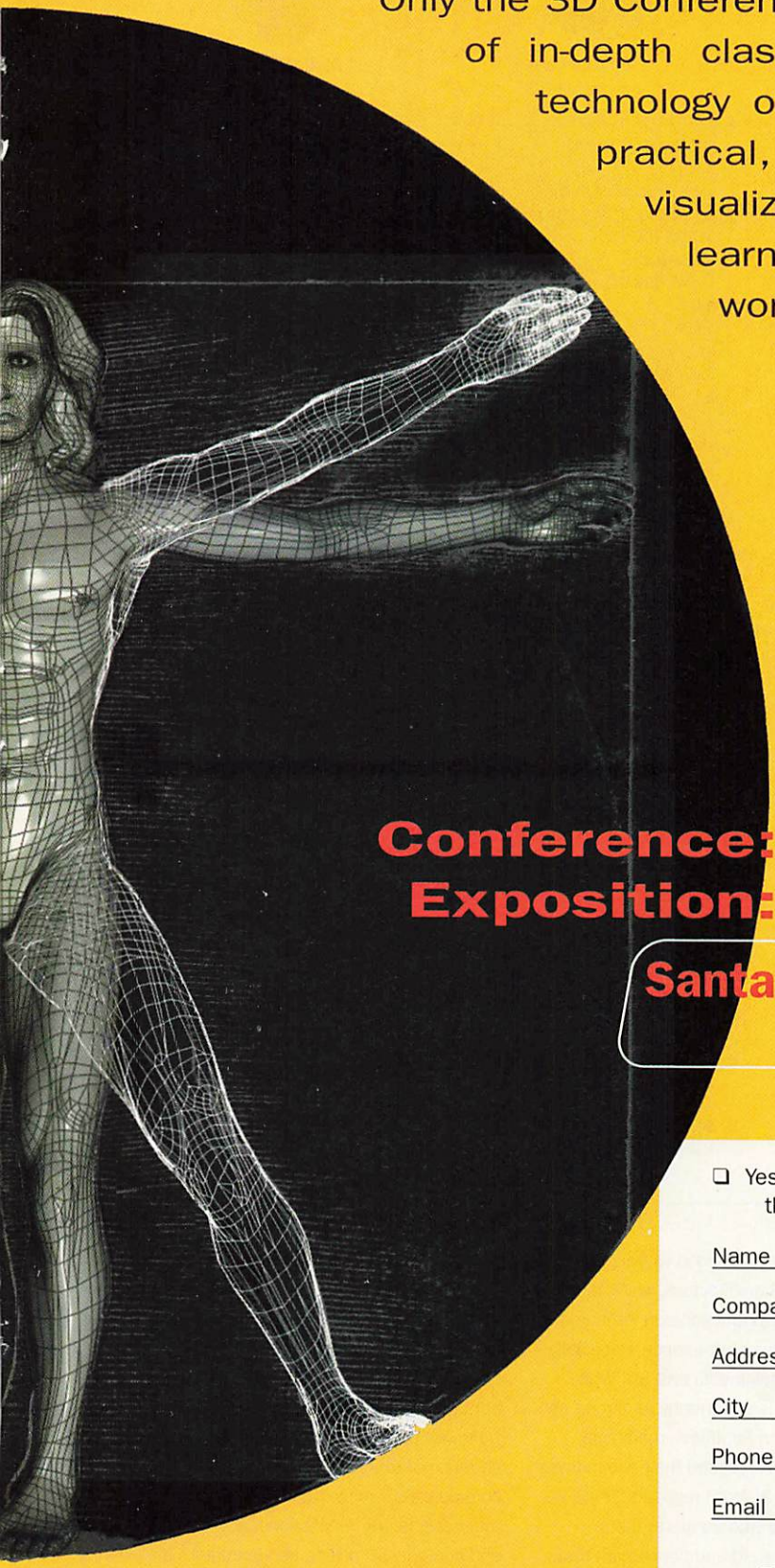

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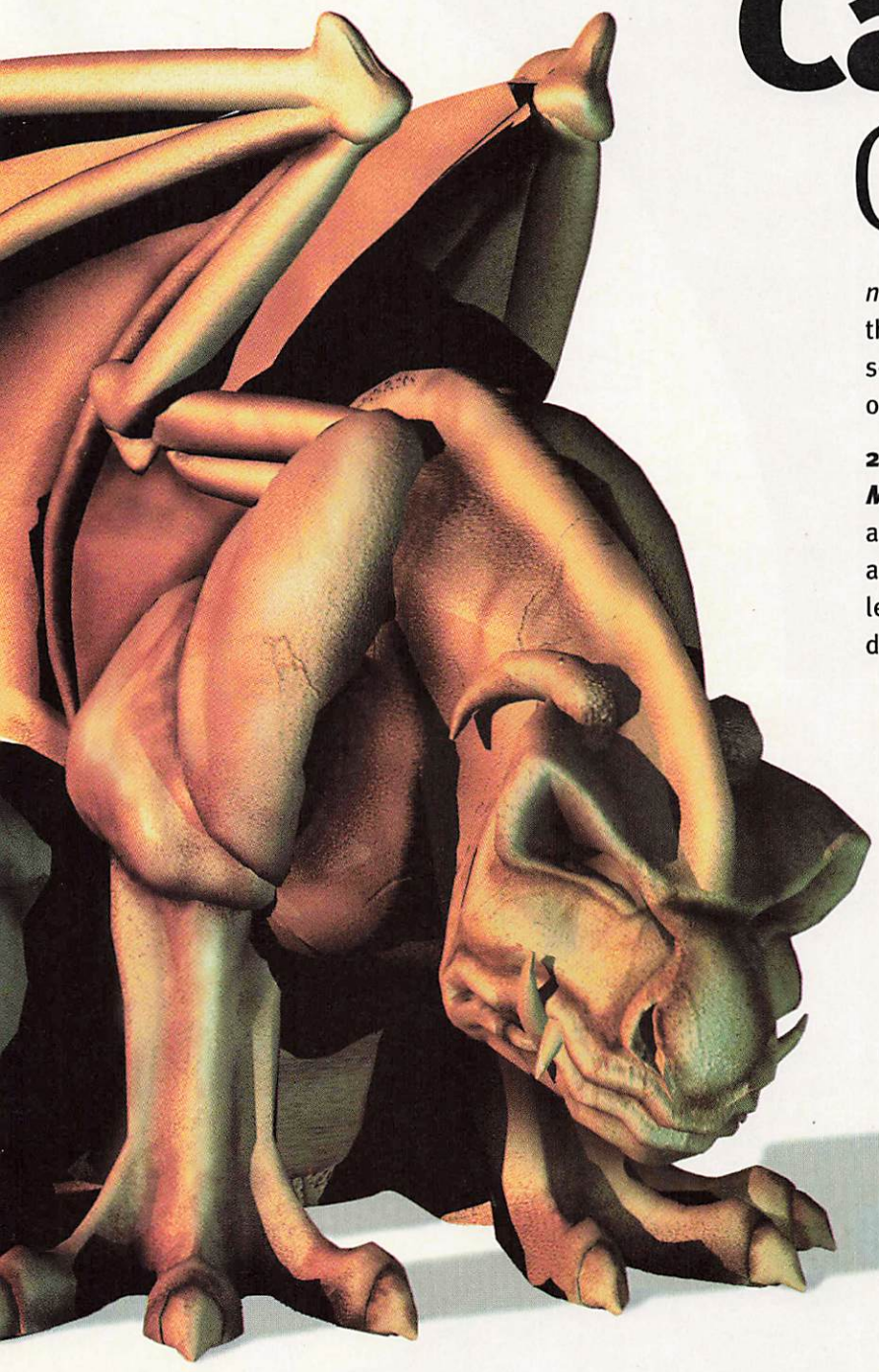

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3D graphics card. It's no Wildcat, but it's not a complete slouch either. 2D performance was excellent. I worked with After Effects, Premiere, Photoshop, and Puffin Commotion, and the 2D screen redraw kept up like a champ. While 3D graphics quality isn't perfect (this was especially obvious when trying out games with major 3D needs), it's clean and performs functions like transparency and alpha stenciling satisfactorily.

The ATI Rage's OpenGL interactivity is the G3's Achilles' heel for professional 3D artists, and I hope the lack of upgrade options becomes moot sooner than later. A Permedia III-based G3 card is available from 3Dlabs and other companies, but I was unable to get a test unit in time for this article. Any company out of the gate with a killer 3D card for the G3 is likely to be rewarded with brisk sales.

An issue that should be considered critical by all graphics professionals is color accuracy. This is an area where the Mac excels, and the ColorSync environment makes it easy to get accurate color from scanning to display to output.

As for rendering, the G3 held its own against the Windows-based systems. Render times were quite respectable in all LightWave tests. The G3 turned in slightly slower scores than the AMD Athlon, which looked quite good in a price/performance comparison with the Intergraph TDZ 2000 GX1. If your business doesn't count on getting every last bit of rendering juice you can squeeze, this machine will perform quite nicely.

Bottom line: As a 3D artist, but more important, as a computer artist, I love this box. It might be more appropriate to say this box loves me. It's fast, it renders even faster, it recovers from crashes easily, and for the money, it's comparable to any PC out there.

Intergraph TDZ 2000 GX1

Let's get the bad news out of the way right off the bat. This baby is expensive, right? Maybe. The good news—it's one bad-ass graphics box. The system was configured with dual Pentium III 550MHz Xeon processors with 512kB L2 backside cache, 512MB RAM, and a 9.1GB, 10,000rpm hard disk. The card is an Intense 3D Wildcat 4105 with 80MB of RAM, currently available only in Intergraph systems.

The sculpted tower case obviously wasn't designed to conserve desk space, but it's so good-looking that hiding it under a desk is a shame. The unit, although large and containing two cooling fans, was surprisingly quiet. It wasn't totally silent, but the hum is minor, and I must admit to being somewhat indifferent to noise to begin with. I like to know my computer is purring away. The unit is built very well, and although the case is a bit difficult to remove compared to the G3's, it's not bad, and the insides are very accessible overall. Some of the internal brackets and parts could be made easier to remove, though.

The mouse is a heavier-duty version of the standard three-button brick you'll find on most workstations. The keyboard, however, is a monstrous molded plastic boombox with a 101-key keyboard attached, complete with an amplified speaker subsystem. It's heavy, hard to put in your lap, and generally a waste of space. If you want decent sound, get some real speakers. If you want to type, get another keyboard.

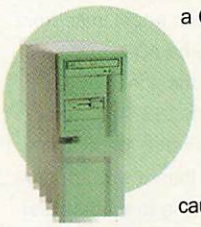
When it came to 3D performance, though, the GX1 was sweet. The Wildcat 4105, with 16MB frame buffer and 64MB texture memory, is the current king of the hill in OpenGL accelerators. I pushed scenes of a quarter-million polys through this box without so much as a hiccup. This is by far the fastest PC I've ever used for any period of time, and it's a joy to work on, at least when NT is working.

Due primarily to the work Intergraph does with 3D application vendors, Microsoft, and other industry leaders, NT tended to feel more stable on this box than on most machines I've used. This is not an evidentiary statement; it's just a perception from working on the unit for a long period of time. It also doesn't mean I didn't have problems. They weren't caused by the hardware though; the culprit was Windows NT and its ironic intolerance for being fault-tolerant. Attempting to read a Jaz disk with a bad sector, the machine locked into an inescapable data-access loop, and only a cold reboot could be performed. To my shock, when the unit turned back on, the operating system was totally blown away. Luckily this happened the day after all my tests had been completed. Let me use this tale of woe as a reminder of the importance of backing up your system and having Windows NT recovery disks. This kind of situation can happen to anyone, any time.

If you're a single user or work for a small shop, you probably need to work fast and render faster to make a decent living. Unless you're already rich and have a render farm, the Intergraph is a great way to go for lots of reasons. It's got fantastic OpenGL performance, excellent rendering capabilities, and dual processors so you can work while you render, and it's built like an armory.

Okay, so I want to own this machine. How does its price stack up with that of roughly comparable machines? I went to the Dell web site and configured a system almost identical in specs to the Intergraph, with the exception that the graphics card was a Wildcat 4000 and not a 4105. The Dell system's price was $200 more! I was surprised, and I challenge you to be a smart shopper and try it for yourself. If you know what you're doing, and especially if you're buying more than one computer, you can get an excellent deal on an Intergraph. Moreover, it's smart to invest in a PC that's easily upgradeable and expandable, and you can't get much more expandable than the TDZ 2000.

AMD Athlon K7 600



I used to be a CPU bigot, at least when it came to Windows-based systems. I was under the impression that any brand name other than Intel could cause problems with high-end apps. Although I'm still not fully convinced that's untrue, my experience with the K7 Athlon was pure pleasure.

Here's my line of thought: CPUs are complicated things. Since literally all the software developers I've asked develop Windows apps on Intel boxes, 100 percent compatibility with non-Intel processors is too much to ask. Nonetheless, my fears were unfounded as far as the K7 was concerned. It performed exceptionally well and never once gave me a problem that I couldn't re-create on the Intel-based Intergraph unit.

The system was a plain vanilla box that housed a prerelease engineering sample of the K7 running at 600MHz, with 512MB RAM and an 18GB E-IDE drive. The graphics card was an nVidia Riva TNT 2 Ultra with 32MB RAM. The box itself was nothing to crow about—which became abundantly clear when

to run fair rendering tests on all three systems. I ran the four benchmark scenes that come with LightWave, so you can run the same tests yourself (see "Testing With LightWave," p. 40). I ran them two ways, with Show Rendering In Progress on and off. The render preview can slow things down, so I've provided both sets of numbers in the chart. I also used a plug-in that measures the time in milliseconds it takes for OpenGL to redraw the screen between frames, a great test of OpenGL interactivity.

Note: For the LightWave rendering tests, I used the default settings as loaded from the scene files. However, each time I made sure the segment memory and anti-aliasing was set right and the render settings (Show Render In Progress, Full Size Display, etc.) were set correctly.

A very telling test is the LightScape Visualization Test from Discreet. I used the 2_rooms.lvs scene file, which contains over 120,000 polygons. Once the scene was loaded, I hit the Orbit icon and let it run for a while to get an average frame rate. This is the kind of test that separates the sheep from the goats in 3D cards.

As a final 3D gasp, I ran a test suite from Maxon, developer of Cinema 4D XL. One of Maxon's tests compares the speed of the test machine to a Pentium 133. A score of 8.4, for example, indicates that the machine renders 8.4 times faster than a similarly configured Pentium 133. I chose to run this test because it works on both Windows and Mac.

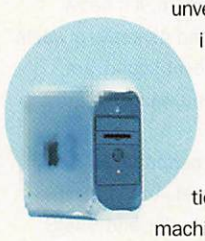
I also ran the test suites from Ziff Davis Labs, which are excellent. Unfortunately, although they include PC and Mac tests, they're not crossplatform. That is, the results of PC and Mac tests can't be compared because they don't measure the same performance factors. These tests are best used to compare the machines I tested to your own PC or Mac. You can download these benchmarks and run them on your computer at www.zdnet.com/zdbop.

I would have run the 3D WinBench tests, but they're not available for Windows NT, only Windows 95/98.

2D performance is just as important as 3D speed, as any user of Adobe Photoshop or After Effects will tell you. So not only did I work extensively with many different apps and many large files, I also ran tests using both Photoshop and After Effects. While the results weren't as strictly quantitative as those of the tests, I felt comfortable that they shed light on the 2D performance of each system. Ultimately, I found 2D performance to be uniformly excellent and hardly worth worrying about.

I used the machines for many hours each, putting each through real-world scenarios and situations a typical 3D artist or animator might encounter in a routine working day. This gave me a definite sense of how well these systems feel and perform. All the benchmarks in the world are useless without a sense of what a machine is like to work with. In each case, I've tried to communicate this and how it relates to the test scores.

Apple G3 400



Until iCEO Steve Jobs unveiled the G4 at Seybold in San Francisco, the .18-micron, copper-chip G3 was the crown jewel in Apple's professional workstation line. Boy, is this machine sharp. No, I mean sharp, like a meat slicer. On an otherwise wonderfully sculpted case, a sharp little lip protrudes under the handles. If you carry the G3 by only one handle, it will shred your knuckles. I discovered this unfortunate fact when, lugging the box down the street, I looked down and noticed blood dripping onto the computer! Otherwise, though, the G3 is one awesome box. The system I tested came with 512MB RAM and a 9GB SCSI Ultra 2 hard disk made by IBM.

Running MacOS 8.6, the G3 is a very stable machine, though it will crash if you push it hard enough, or sometimes even if you do nothing at all. MacOS, though, is much easier to work with than NT, and it recovers more easily from a complete system crash as well. It's very user-friendly, and the file management system is much more in sync with the creative mind than the Microsoft approach.

Unfortunately, MacOS lacks pre-emptive multitasking; that is, the ability to run a program in the background while running another app, such as using Adobe Photoshop while rendering via Play Electric Image in the background. Also, there is no direct control like the shell in UNIX. OS X is due soon, however, and it promises the multitasking and direct access of UNIX with a Macintosh GUI. If it performs as advertised, it'll be fantastic for digital artists. Not only will it make the Mac that much better, it will also raise the bar for what we demand from an OS.

The G3's case opens with a pull of a lever, even while the unit is switched on. This arrangement makes system upgrades and maintenance easier than on any other PC I have seen. The motherboard is mounted onto the panel that folds out, which facilitates easy access, leaves ample room for extra drives, and makes adding extra cards or RAM a snap. This is a well-thought-out machine, and it's obvious that Apple put a lot of effort into the ergonomics and functionality of the box design. While it doesn't have all the expansion slots you might want (not even a NuBus slot for legacy Apple cards), third-party options make it possible to integrate older gear, and artists who are just starting down the hardware path need not worry.

Apparently, the legacy of legacy hardware is spent, at least as far as Apple iCEO Steve Jobs is concerned. Hence, no floppy drive and no standard SCSI. (An Adaptec SCSI card is optional, and the system I examined came with one.) 10/100 Base Ethernet is built in and networked via AppleTalk. Two USB and two FireWire (IEEE 1394) ports are provided plus a serial ADB port, so you can still hook up your old dongles and Wacom tablets. The control panels are easy to figure out and system extensions are easy to turn on and off—in this respect, Mac has Windows beaten hands down.

The keyboard and mouse, which together take up one USB port, are a joke. You can use your old keyboard and mouse via the ADB port, but that defeats the whole design scheme. The alternative, however, is much worse: the standard-issue iMac keyboard and mouse. The donut mouse is impossible to keep straight. Apple needs to fix this problem immediately, or I might organize a donut-shaped-mouse stoning in Cupertino. Mine hangs on the wall as a reminder of how not to design UI peripherals. Fortunately, Macally makes a nicely color-coordinated line of high-quality keyboards, mice, and trackballs for the G3 (www.macally.com).

The graphics card is an ATI Rage 128 with 16MB RAM, a decent entry-level 2D and

by Chris Tome

Three Platforms for Three Dimensions

Benchmark test results for the Apple Macintosh G3, Intergraph PIII, and AMD K7

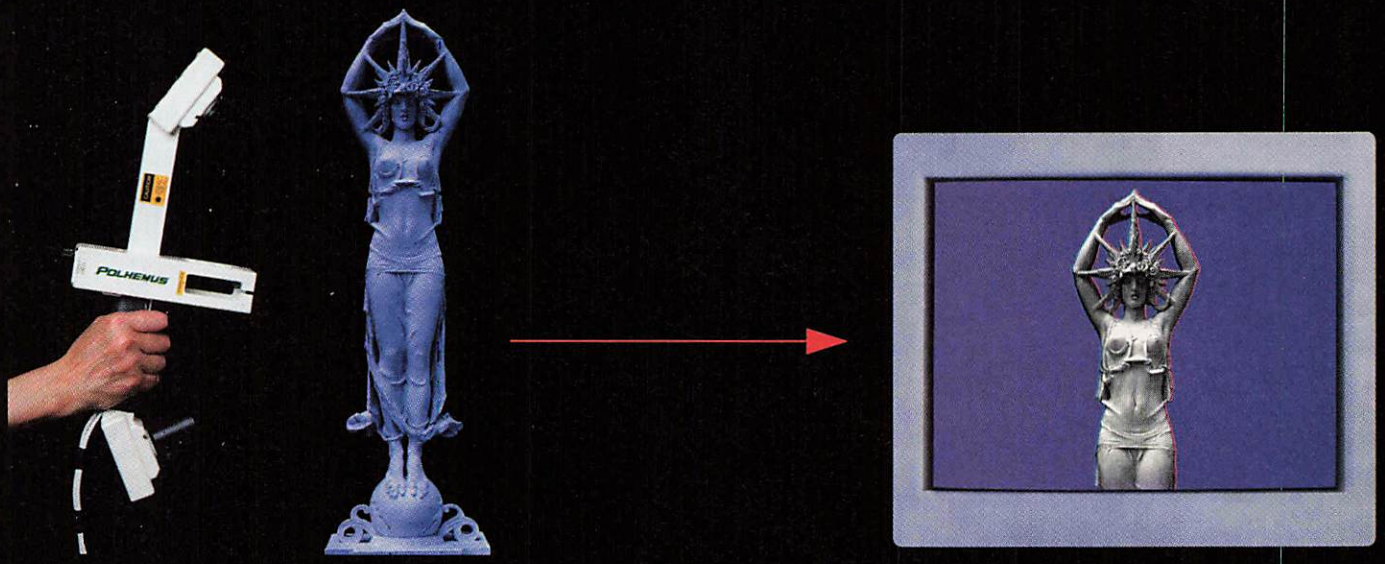
Let's start with three questions. First, is a top-of-the-line workstation worth the expense? Second, if you're shopping for a Windows box, is there an alternative to Intel? Third, is the Mac G3 a viable 3D workhorse?

Intergraph is known for well-built NT workstations. No corners are cut on these purple behemoths, so I decided to answer the first question by torture-testing one of their best, the Intergraph TDZ 2000 GX1. Meanwhile, a preproduction clone arrived here at *3D* Central built around an AMD K7 600MHz chip, so I decided to answer the second question by putting it through the same workout. As for Question 3, the Mac is uncontested as a platform for 2D graphics. The latest models are enticing for 3D, but they have yet to prove themselves to most people in the field. To find out whether they cut the mustard, I put an Apple G3 400 to the test as well.

Although what follows is a comparison, it's not a shootout. It wouldn't be fair to consider these systems as equals. They're not. In fact, each one was totally different at its very core, the CPU. Although they were configured similarly, each machine carried a disparate price tag as well. The chart that accompanies this article shows where each of these systems performed well, where each one fell short, and what kind of price-to-performance ratio you can expect. It will make the most sense if you keep in mind that each system tested was selected as an outstanding representative of its class, not because it was comparable to the others.

Keep in mind that price and performance, although mission-critical, aren't the only reasons to choose one machine over another. Issues like operating system, ease of use, customer service, and upgradability can play a big role in the decision-making process. This is as it should be if you expect the decision to be one you'll be happy with for some time to come.

The Tests Amid my benchmarking travails, I came to the conclusion that a great need exists for a comprehensive crossplatform graphics benchmark program. In many areas of performance, I was able to find crossplatform tests, but in many others I wasn't. Luckily, NewTek LightWave 3D runs on both platforms, so I was able



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admits. "It took a lot of repetition. The difference between animating fluid and animating characters is that you don't get pose positions to interpolate between. You get things like hoses, water jets, and water absorbers. You can control the timing, but by no means are you posing the shape of the water. You're not able to draw a picture of something and say, 'simulate to that shape.' Instead, you control characteristics of the motion. Like, if I wanted to make it violent, I'd make sure the curves that control the jets were going up and down wildly, or something like that, to get a lot of kick and secondary motion happening.

To use this kind of technology effectively, Foster advises animators to "shift how you think about animation. You have to pretend this is real physics. To begin with, most people find that quite difficult, but if you can think that what you're really doing is throwing around a bucket of water, it becomes a lot easier."

Once parameters of the simulation had been determined, the simulation was plugged into PDI's renderer. The particles were replaced with fish and the shot was rendered using the same watercolor effect as the rest of the film.

Little Big Time

The making of *Fishing* stands as a prime example of how a big-time film effects house can direct the creativity of its artists into a dynamic filmmaking process. Here, too, the contradictions are notable. Gainey conceived the project on his own and maintained a solid personal vision of the final outcome throughout. Yet he made the most of PDI's fertile creative environment, taking full advantage of the strengths of the talented people around him. Even though he managed a textbook preproduction effort, he remained flexible about all aspects of the film during production. Even story points changed right up until the end. This sort of tug-of-war between preparation and improvisation is a hallmark of filmmaking at its best.

Amid what one might reasonably expect to be a sweatshop atmosphere, everyone involved in *Fishing* expressed satisfaction with PDI without prompting. This in itself is an excellent lesson. Even if their visual style is too eclectic to ape, their methods and atmosphere are well worth emulating.

Barrett Fox is a founding member of infoplasm (www.infoplasm.com), a San Francisco-based interactive content creation company and producer of the 3D web cartoon The Information Overload Overlords. You can contact Barry at pajamas@sirius.com.

fishing vital stats

The Team:

David Gainey, direction, animation, and story

John "JR" Robeck, producer

Carl Rosendahl, executive producer

Cassidy Curtis, watercolor rendering effects

Nick Walker, modeling

Irene Deery, character setup and technical direction

Melissa Tseng, effects setup, lighting, and technical direction

Mark Edwards, lighting and technical direction

Rachel Falk, second fish animation

Scott B. Peterson, ripple and fish animation

John Dorst, editing

John Hanashiro, film recording

Marco d'Ambrosio, music composition

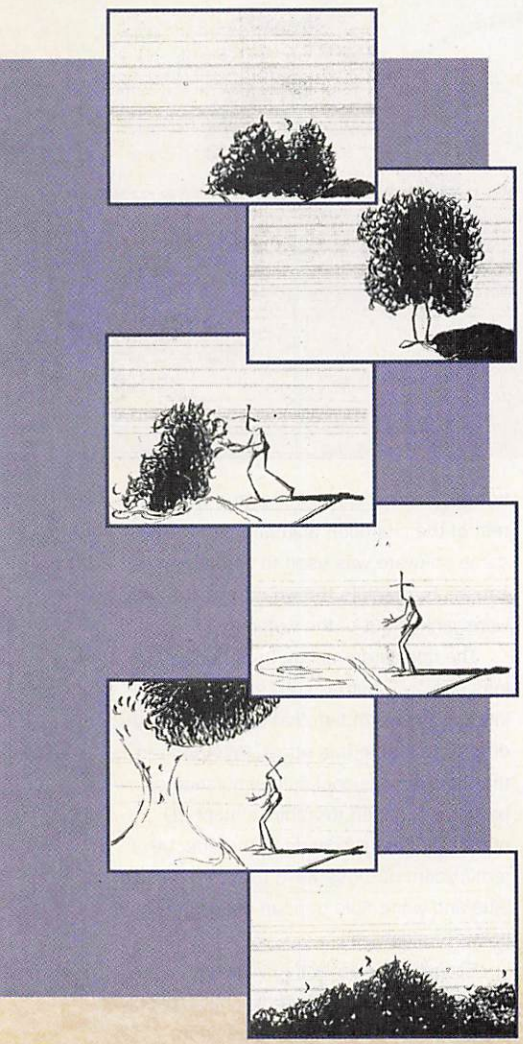
Cappuccino, music performance

Larry the O, sound design

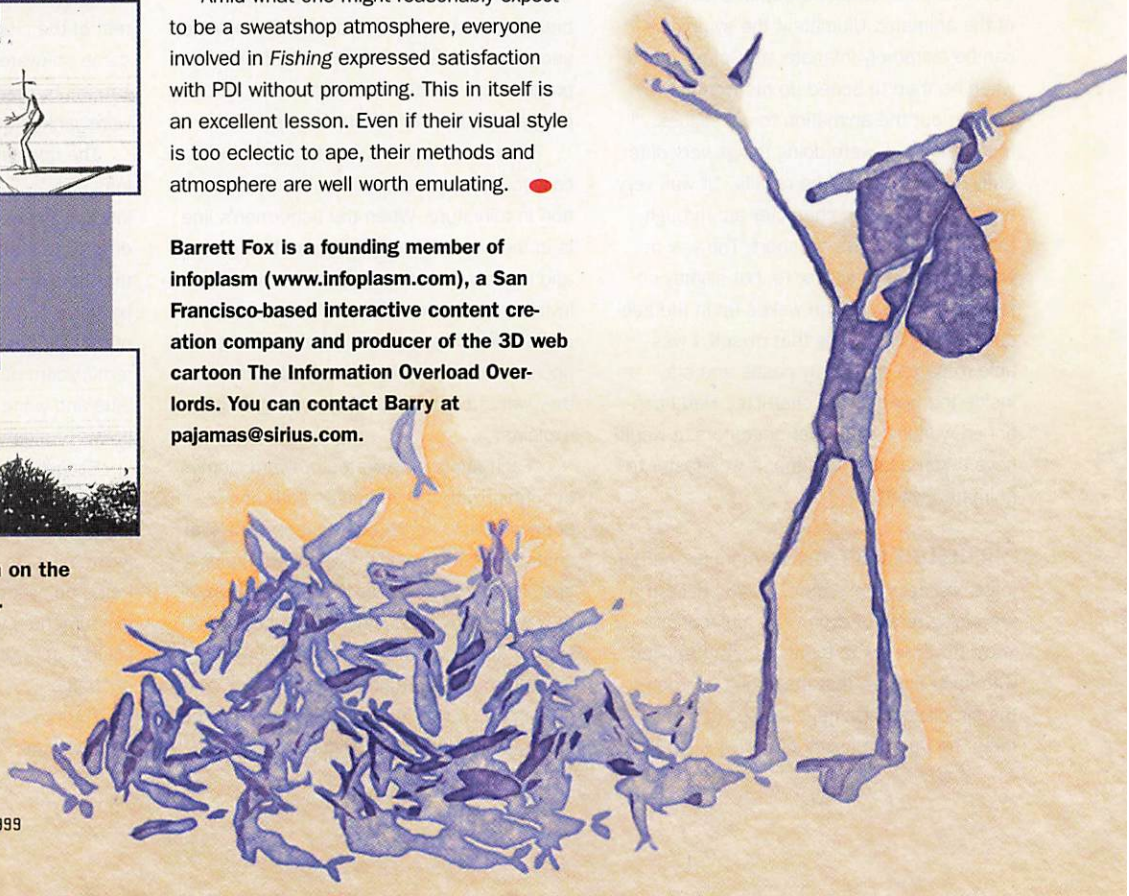
MarcoCo Studios, audio postproduction

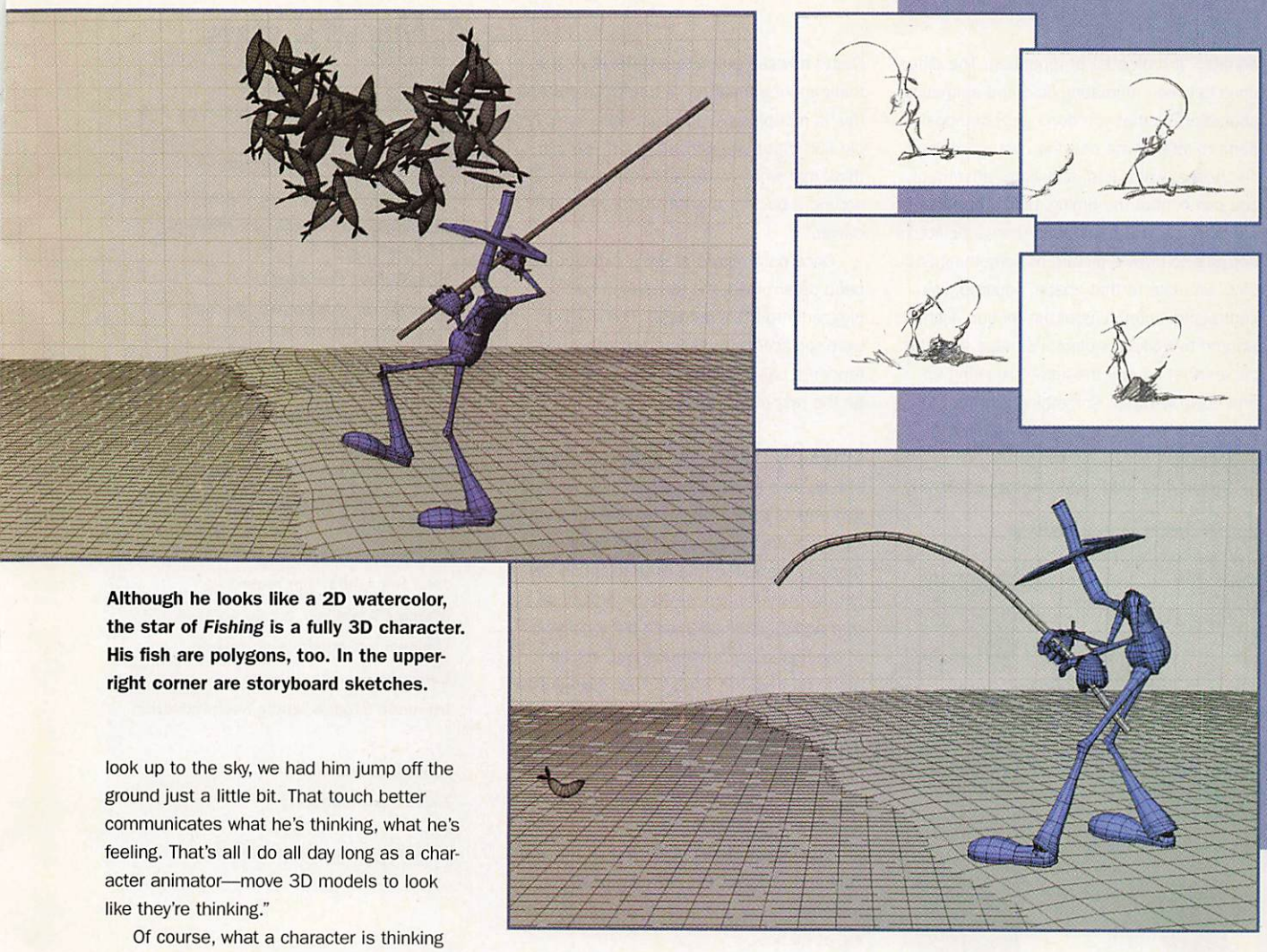
Hardware: SGI O2

Software: proprietary



A tsunami of fish rains down on the fisherman in this storyboard.





Although he looks like a 2D watercolor, the star of *Fishing* is a fully 3D character. His fish are polygons, too. In the upper-right corner are storyboard sketches.

look up to the sky, we had him jump off the ground just a little bit. That touch better communicates what he's thinking, what he's feeling. That's all I do all day long as a character animator—move 3D models to look like they're thinking."

Of course, what a character is thinking depends in no small part upon the thoughts of the animator. Ultimately, the symbiosis can be extremely intimate, as Gainey found when he tried to speed up his workflow by farming out the animation to colleagues. "I found that they were doing things very differently than I thought," he recalls. "It was very difficult to keep the character arc through the film because it's so short. The way he wakes up here is similar to, but slightly different from, the way he wakes up in the second half. By animating that myself, I was able to better match my poses and stay inside the head of the character. Had I continued working with other animators, it would have taken a lot more time. It was faster to animate myself."

Simulated Fish

Complementing the delicate character animation, *Fishing* utilized a surprising array of dynamic simulations. You'd never know it, though; they're applied with such finesse that they don't overpower the simplicity of Gainey's vision. To create them, he had the luxury of calling upon Oscar-winner Nick Foster and his groundbreaking fluid dynamics simulation software, known as Flu. Scott Peterson, a PDI effects programmer, ran the fluid simulation and programmed some effects from scratch.

Peterson created a special tool specifically for *Fishing* that was itself a fluid simulation in miniature. When the fishermen's line is in the water, it creates ripples that grow and interact with one another and with the invisible shoreline. "The animator would place where they wanted the center of the ripples and choose how many little lines they wanted in the ripple," the programmer explains.

"Each ripple propagates outward, comes in contact with the shoreline, and then bounces back. I gave David some high-level control over the ripples, like speed, their size, how close together they were, when they were activated. There was a second type of ripple where the fishing line runs through the water. It creates more of a V ripple than a circular ripple. That ripple ran the same simulation with a slightly different behavior. It's all tightly integrated with the rest of the character animation tool." The same software was used to create ripples caused by droplets thrown off by fish as they were yanked out of the water.

The ripples are subtle but effective. No less effective, but far from subtle, is the immense wave of fish that engulfs the fisherman. To create this effect, Peterson ran the three-dimensional fluid simulation on particles confined to a thin, almost 2D plane. The test rendering of the effect is reminiscent of those wave toys that contain blue and white fluid trapped between two layers of plastic.

Because the software is based on the physical principles of fluid dynamics, directing the animation is worlds away from keyframing. To get the look Gainey wanted, Peterson, working from the storyboards, experimented with the direction, velocity, and volume of "water jets" and with the position of "baffles."

The procedure was every bit as abstract as it sounds. "It was very hard," Peterson

grayscale 3D renderings of the character to determine which areas of shading would be assigned which colors.

By breaking up the problem into components, Curtis was able to simplify the difficult task of creating organic, fluid watercolor rendering effects. Analyzing the look of watercolor painting, he noticed the uneven outlines created by the way water travels through the grain of rough watercolor paper. Pigment collects along the edges of a wet patch, darkening the edges of the wash. The texture is a combination of the grain of the paper and the watercolor itself. Finally there is transparency between the layers of washes and the paper itself.

Once Curtis had worked out the features of his rendering process, he worked with a Gainey to determine how to apply them to the character model. "At one point we were talking about just going with the shadow," Gainey recalls, "but we realized we could better define the character if we were matting out negative space." They accomplished this by creating washes of a lighter secondary color that wasn't part of the character but defined its brighter edges.

Curtis analyzed not only the behavior of watercolor paint and paper, but the behavior of the artist himself. "He could describe what every brushstroke was for in his paintings," he observes. "He could say, 'this one over here is to indicate shadow, and this one over here is to indicate the negative space of the background.' And I could take from his instructions, and from looking at the paintings, a set of rules for how things should behave.

"What was great about David's art direction," he says, "was that he could just give you a painting and say, 'I want it to look exactly like this.' Which is a miracle. You don't get art directors that can do that most of the time. It's usually, 'show me something and I'll tell you when I like it.'"

Antz veteran Irene Deery set up the IK character armature. Setting up IK for an asymmetrical character, she learned, requires twice as much work. Instead of being able simply to duplicate the left limb to set up the right, she had to create a unique IK chain for each. She provided controls to animate not only the major body parts, but also the stomach, the bend of the fishing pole, and the bend of the hat.

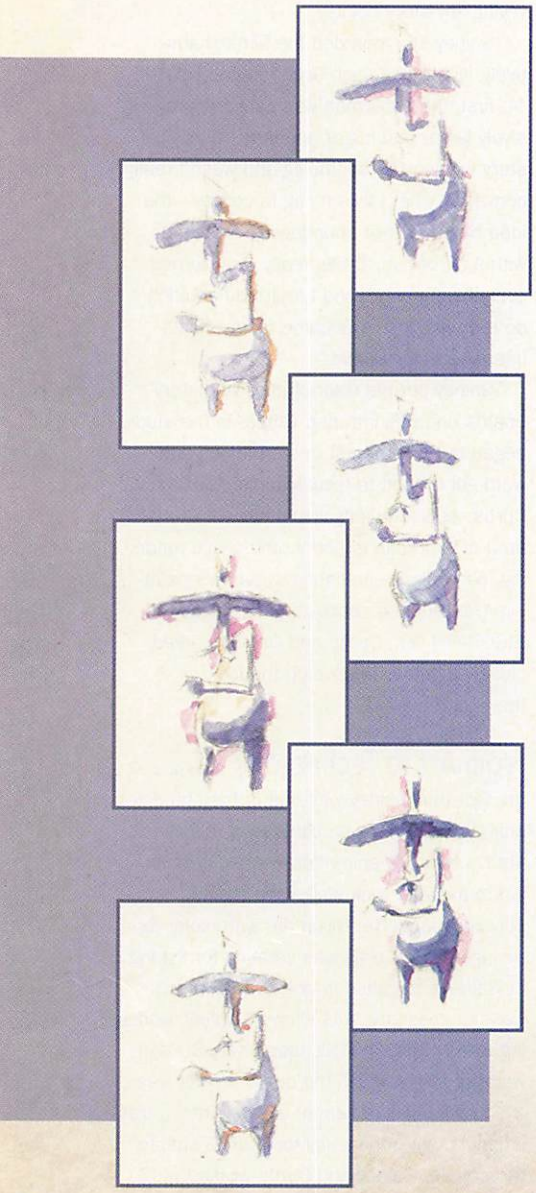
Deery created controls that enabled Gainey to curl all the fingers at once for simple gripping actions. One hand was linked to the fishing pole with a sliding joint, while the other remained stationary on the pole. Once again, collaboration between animator and technical director ensured that the animator's special needs during the animation process would be met.

Animation Insights To animate the film, Gainey paid close attention to visual composition, or staging. "One reason it feels two-dimensional or hand-drawn," he points out, "is simply the way we presented the action of the character. All the action happens left-to-right or up-or-down, and there's very little perspective change in the film.

"All the animation is done through silhouette. Watercolor lends itself to a gestural approach. We had to communicate everything without a face, without expressions. We used his whole body to communicate, using his hands, using his feet when he's snoring, anything to convey what's going on. We didn't want to cut in to a close-up of his face, so all of those things had to be conveyed in a broader animation style.

"For example, in the section where he pulls the fish out, at one point we had him looking at the fish and shaking his head. It was difficult to read what he was doing. It was a little bit too far away, and his head is a cylinder, so he's shaking his head and it's just rotating and you're not seeing anything. Trying to get that action to read was a challenge." To solve this sort of problem, Gainey resorted to body language, such posture, gait, and the like.

"Character animation is all about what the character is thinking," he points out. "At times, he was getting lost. Is he is happy or sad? So we punched it up. Rather than having him just



These are more fisherman color tests. Here he's being shown in different lights.

ented character animators from *Antz*. This little film is also full of fascinating contradictions. Fully expecting to be dazzled by a big-studio tour de force, my brain had to switch gears to appreciate a subtler aesthetic.

Visually, *Fishing* is extremely understated. The imagery consists of little more than a faceless stick figure and some fish, apparently painted in watercolor on textured paper. The music is similarly simple; dialog and background mattes are entirely absent. It stands in stark comparison to other big-studio shorts, such as Pixar's *Geri's Game*, whose animation innovations are stunningly evident. Yet this simple film required some of the most talented special effects programmers in the industry.

Story Development

The story unfolds as "more poem than regular story," in Gainey's words. In the morning light, a fisherman stands on the beach waiting for a bite. After a short while, he hooks a small fish, throws it back, and casts for more. Next, he reels in several fish, exhibiting growing surprise with each new catch. Soon he's catching fish after fish, flipping them from the water, over his head, and onto the shore next to him. After showing his satisfaction in a little triumphant dance, he casts his line again. This time, the fisherman is inundated by a giant wave consisting entirely of fish that fills the screen. The wave recedes and we see, in the late afternoon light, the fishermen snoring, asleep on the shore. With a start, he awakes as if the whole story might have been a dream. He makes as if to throw his lone remaining fish back into the water, thinks again, and walks offscreen contentedly.

Gainey began developing the story and character at home during his spare time, away from his computer. An avid watercolorist, he painted numerous color treatments of the fisherman, paying attention to the subtle interactions of colors and to the textures of the resulting washes. "One idea of the story is the passage of a day," he explains, "so the shadow is important, the light is important. How can we further convey the changing time of day? And one way we could do that with watercolor was through color." Examining Monet's cathedral paintings for inspiration, Gainey chose separate color palettes to represent different times of day.

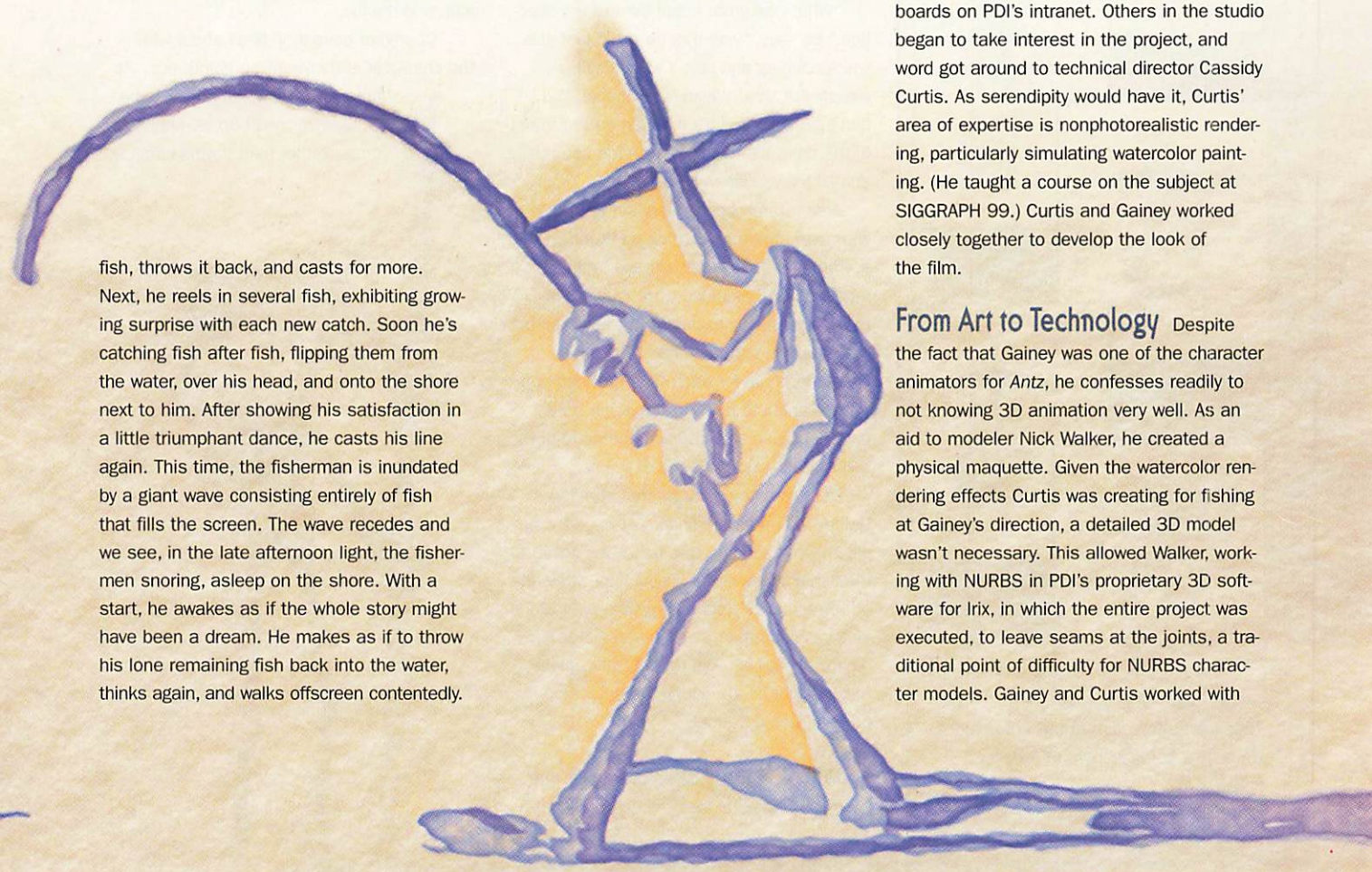
From the start, he wanted to give the film a two-dimensional, illustrative, minimalist look, as opposed to the look of most 3D animation. The character was designed so that every part of his body, clothing, and equipment could be used to tell the story. Hands, feet, and hat were made large because of their rich communicative potential. Anything that wasn't pivotal to telling the story—the reel of the fishing pole, the ground, the sky—was removed. The character was designed asymmetrically to give it a loose, hand-drawn appearance. "One leg is slightly skinnier than the other leg, one hand is slightly bigger," Gainey points out. He paid special attention to the character's silhouette, since the silhouette and the negative space around the character would be pivotal in conveying key story points.

Gainey storyboarded the film exhaustively, illustrating each action in great detail. "At first, the fisherman was catching progressively larger and larger and larger fish. That story was sort of confusing and wasn't really conveying what I was trying to convey—the idea of the sort of abundance that comes with a lot of fish. That's really what turned everything around, and I realized I couldn't do it on my own. It became more effects-intensive at that point."

Gainey put his color studies and storyboards on PDI's intranet. Others in the studio began to take interest in the project, and word got around to technical director Cassidy Curtis. As serendipity would have it, Curtis' area of expertise is nonphotorealistic rendering, particularly simulating watercolor painting. (He taught a course on the subject at SIGGRAPH 99.) Curtis and Gainey worked closely together to develop the look of the film.

From Art to Technology

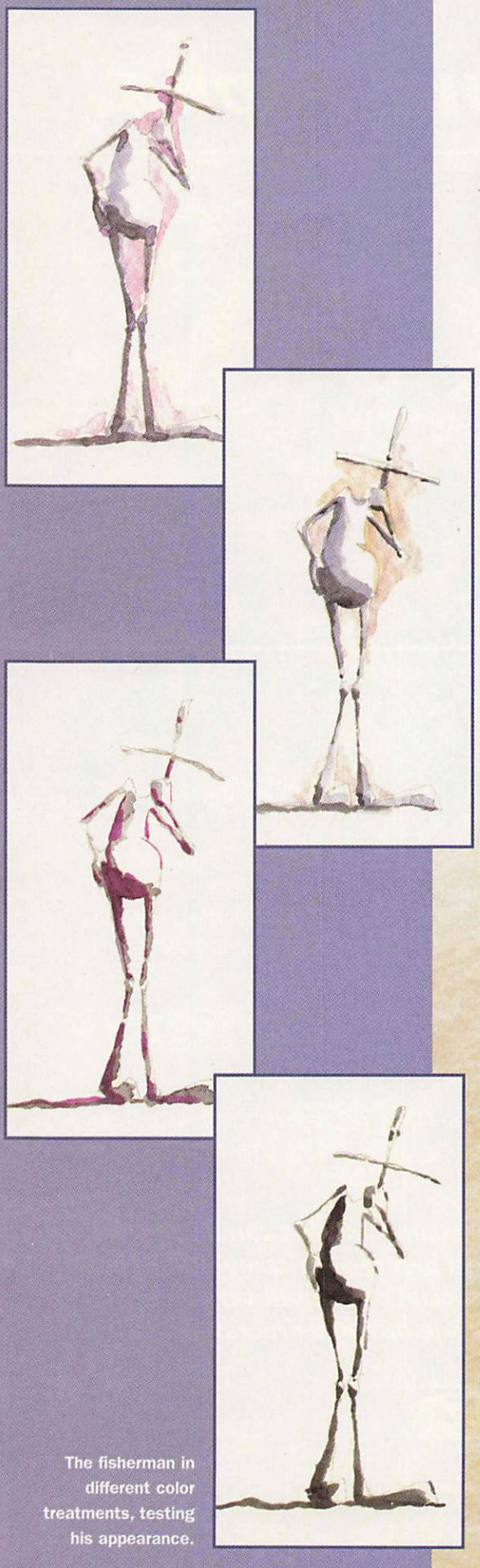
Despite the fact that Gainey was one of the character animators for *Antz*, he confesses readily to not knowing 3D animation very well. As an aid to modeler Nick Walker, he created a physical maquette. Given the watercolor rendering effects Curtis was creating for fishing at Gainey's direction, a detailed 3D model wasn't necessary. This allowed Walker, working with NURBS in PDI's proprietary 3D software for Irix, in which the entire project was executed, to leave seams at the joints, a traditional point of difficulty for NURBS character models. Gainey and Curtis worked with



by Barrett Fox

Angling for Style

The vision & technology behind PDI's animated short *Fishing*

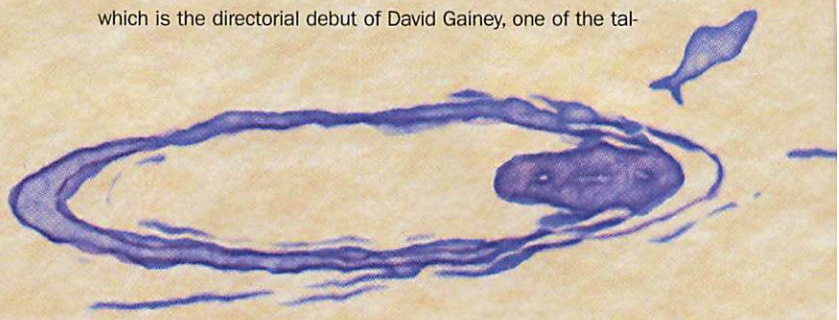


The fisherman in different color treatments, testing his appearance.

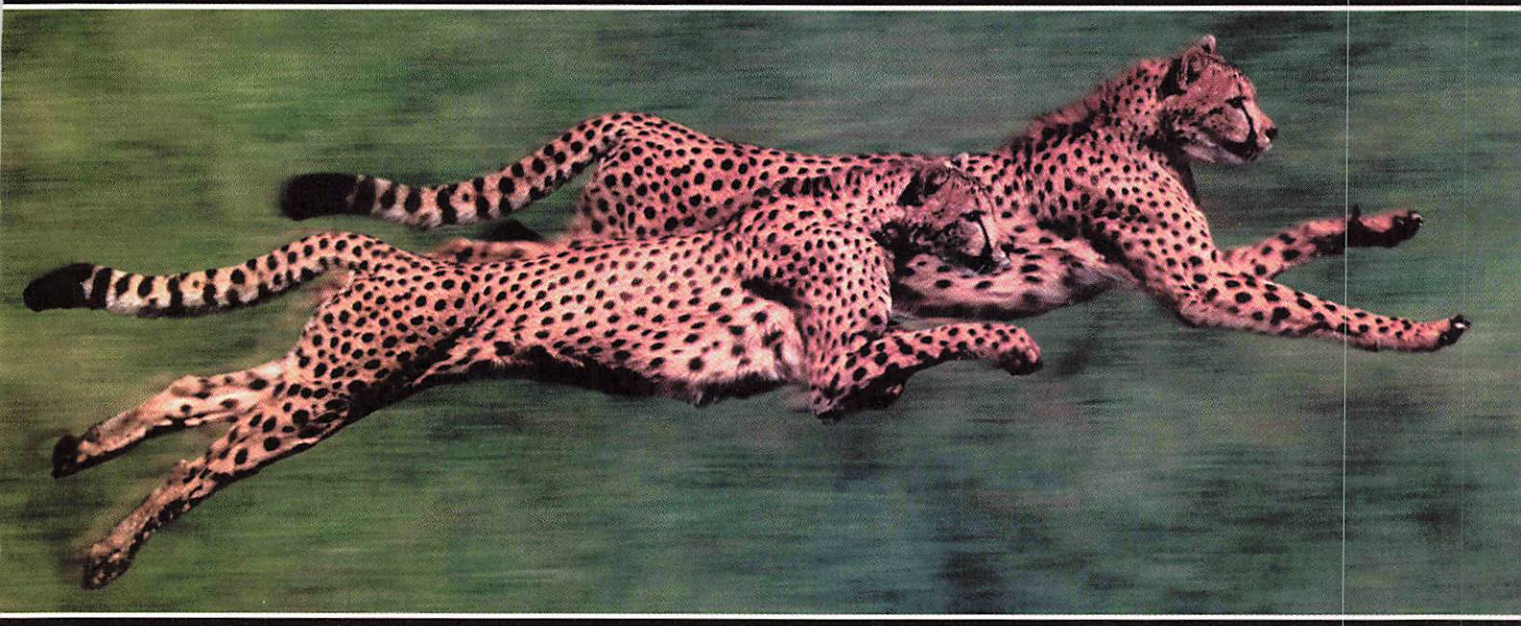
Sitting in the waiting room at Pacific Data Images, or PDI, one of the country's foremost visual effects facilities, is a somewhat contradictory experience. Hidden in a nondescript building in the utterly nondescript Silicon Valley, there's no clue you're even at PDI until you get in the waiting room. Here, the cool, corporate architecture is offset by a genuinely funny receptionist who sports some pretty cool tattoos. Along with pictures of PDI's giant films, *Batman* and *Antz*, is a picture from *Sleepy Guy*, a quirky short film by PDI employee Raman Hui that's a favorite among hardcore animators. The trophy case has a couple of Oscars in it and the door has a security buzzer, but the atmosphere inside is casual and easygoing.

PDI, it turns out, is full of juicy contradictions. It's a giant studio that employs over 300 people and produces some of the most ambitious animated feature films. It produces industrial strength special effects for megablockbuster films. Yet its animators produce an eclectic array of animated short films that studiously avoid adhering to a signature PDI style. Instead, the various PDI shorts serve as a rich test bed for new animation styles, techniques, and directorial storytelling. Instead of the tight managerial and creative reins typical of large creative companies, PDI animators are encouraged to explore their creative voice. PDI shorts show up not only in numerous animation festivals but also in the prestigious SIGGRAPH Electronic Theater, where films are selected for innovation in computer graphics.

I've come to PDI to see the latest of their short films, *Fishing*, which is the directorial debut of David Gainey, one of the tal-



Nothing outruns Alpha.



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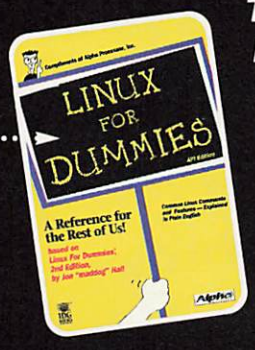

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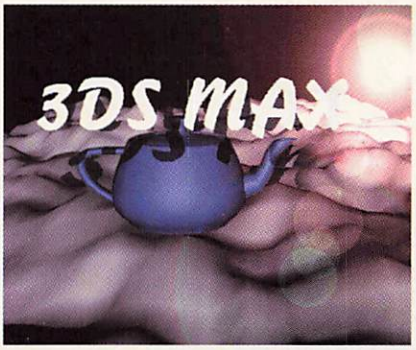


FIGURE 12. The lens flare looks better with Shading turned off.

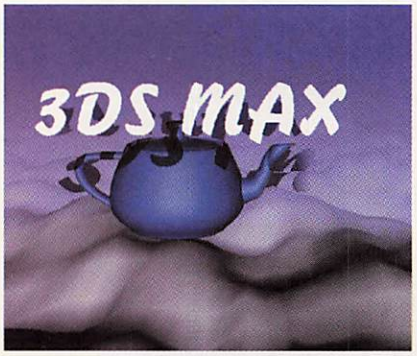


FIGURE 13. Fast fogging in effect*.

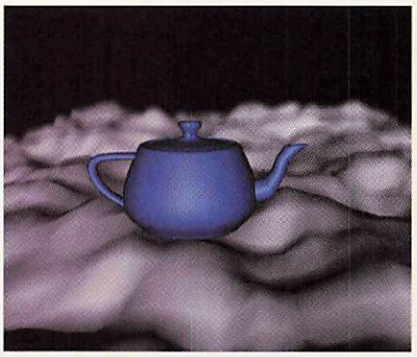


FIGURE 14. Depth of field is one of effect*'s many effects.

FIGURE 15. effect*'s Glow uses MAX's object IDs.

radius, intensity boost, minimum luminance, and falloff. You can't set the glow color, though; the effect picks up the color from the image. In Figure 15, Shading is turned on and the effect is still apparent (with the settings jacked up). It's more noticeable with Shading turned off.

Most transform operations between 2D and pseudo-3D objects in effect* take place practically in real time. Special effects take longer, but they're still fast and very nice to have. With such fast feedback, you can try many different methods of combining your content without becoming frustrated by long delays. Of such interactivity is creativity born. Moreover, rendering effects such as fog in 2D rather than 3D can save tremendous amounts of time. There's really an incredible amount of cool stuff you can do with effect* and MAX, as long as you can live with the limitations and maintain an awareness of the differences between MAX objects and effect* objects. The two programs make a pretty good team already, and I look forward to seeing what Discreet can do in the future to make them work together even more effectively.

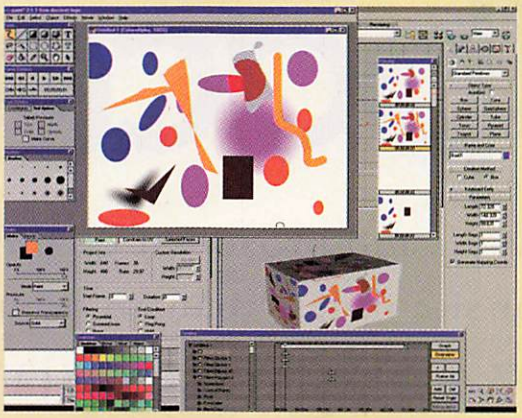
David Duberman is a technical writer specializing in 3D graphics, based in Berkeley, CA. You can contact him via email at duberman@dnai.com.

Discreet paint* & 3D Studio MAX

When you create an image in Discreet paint*, rather than drawing pixels directly on the digital canvas, you produce splines, much like those 3D Studio MAX uses for its shapes. The program then converts these to areas of color, but it retains the underlying vector, so you can always go back to an individual paint* element and transform or reshape it, or change its color, brush stroke type, and so on. If you use MAX 2.5 or 3, you can draw directly onto 3D objects using paint*'s brushes. Alternatively, you can draw in paint* and see the results immediately in MAX. Creating texture maps from scratch doesn't get much more interactive than this.

The magic is accomplished by means of a MAX plug-in that lets you use a Paint map type in a material, typically in the diffuse channel. Then, in the Paint map's Parameters rollout, you click the Edit button, which runs paint* and starts a new project. Thereafter, when you draw in the paint* window, the texture updates automatically in any MAX viewports set to Smooth + Highlights. Similarly, you can use any of paint*'s effects, such as Blur and the various painting modes, to draw elements with real-time feedback in MAX. What's more, because paint*, like effect*, supports keyframed interpolation of just about anything you do, you can create animated texture maps easily.

You might be attracted by the Paint map's Paint button, which lets you draw directly onto MAX objects in the viewport. It works, but it's very limited. For example, you can't see what you're drawing until you release the mouse button, and you can't change tools or even undo strokes without returning to paint*. Also, unless you're using a regular-shaped object with standard mapping parameters, chances are you won't get what you think you're drawing; this is typical of 3D painting. In such cases, you might do better with the Unwrap Selected option, which depicts the mesh you're painting on in the paint* window. Another drawback to the whole system is that the screen can get cluttered with all the different windows, as you can see in the figure. Those who own two-monitor setups will be thankful they made the investment.



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Rapid 3D #10

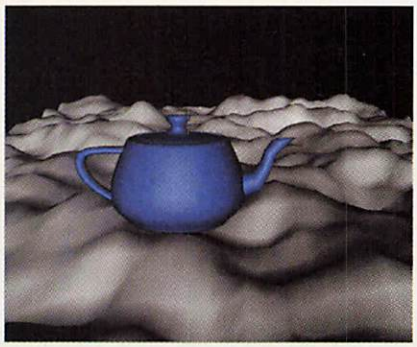

FIGURE 6. An RLA file with MAX lighting.

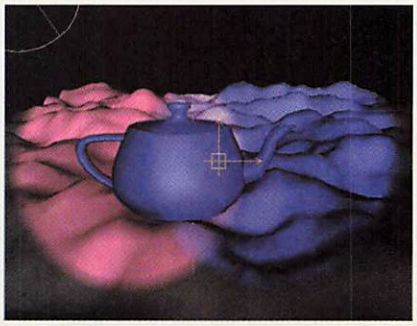

FIGURE 7. Lighting the flat image with effect*'s colored spotlights.

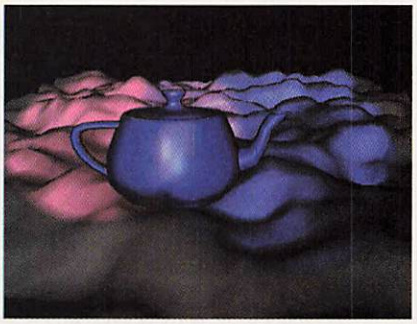

FIGURE 8. 3D lighting in effect*, with specularity.

imported. Figure 6 shows an RLA file as lit in MAX. The composition contains two spotlights, but they don't illuminate the image. If you turn on Shading, the effect* lights illuminate the image as if it were flat, as in Figure 7. For some images, this works well, and nothing further is necessary. But for a realistic 3D effect, at the cost of a small degree of additional processing, turn on Use 3D Shading for the RLA file. This turns off any lighting imported from MAX and uses only effect*'s lights. The effect (pun intended), as shown in Figure 8, is quite convincing, especially if you animate the lights (just about any setting can be animated in effect* via keyframing). For added verisimilitude, I also turned up the RLA file's Specular setting.

Related to shading is effect*'s shadowing capability. It's pretty straightforward: Turn on Shadows, and objects cast realistic shadows, as depicted in Figure 9. Note that only different objects in the effect* composition can cast shadows on each other; because the teapot and landscape are part of the same object, the teapot can't cast a shadow on the landscape. effect* raytraces shadows, so response isn't quite real-time, even with a dual Pentium II/450 system. But it's fast, thanks in part to multithreading of shadow operations.

To get reflections, you turn on that option and set Reflectivity values for any objects you want to reflect others. You can choose among 25 reflection modes for each object, including Normal, Dissolve, Add/Subtract, and Posterize. Figure 10 uses the Negative reflection mode, resulting in an orange reflection of the white text in the blue teapot.

Incidentallay, effect* can override its own camera settings with camera data from imported RLA files. So if you've set up a precise camera animation for your 3D scene, you can use it in effect* with minimal effort.

Special Effects with effect* True to its name, effect* provides a host of special effects, but 3D Post, the first sub-menu on the Effects menu, is of particular interest to MAX users. These, by the way, are available only with effect* option 2, the high-priced spread. 3D Lens Flare lets you place the flare center and angle interactively, and it gives you settings for color, intensity, rotation, and others. I found it difficult to use. With Alpha Transparency and Shading turned on, as in Figure 11, the effect is subtle at best. It's only if you turn these off, thus losing many of the benefits of RLA, that the lens flare can strut its stuff (Figure 12).

Likewise, effect*'s fog is more effective if you turn off Shading, although it's fine with or without Alpha Transparency (Figure 13). In fact, you can set it to affect the mask or not. Other settings include two colors to create a gradient (blue and white in Figure 13), with positions for both. And you can use another object in the composition as the fog source, which lets you use animated textures for fog such as fractal noise or turbulence.

The Depth of Field effect is quite impressive—again, provided you turn off Shading. Only three settings are provided: the plane of

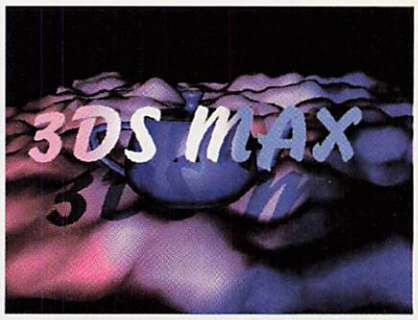

FIGURE 9. effect* lights can cast 3D shadows.

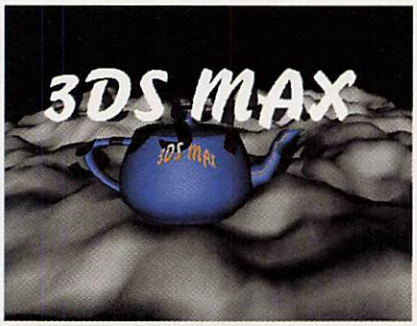

FIGURE 10. 3D reflections on the teapot.

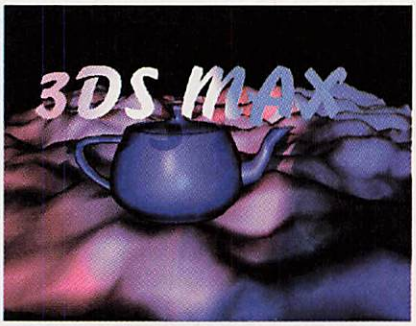

FIGURE 11. Lens flare is hard to see with Shading turned on.

focus, which you can pick in the image; the maximum blur radius; and the blur type (box or Gaussian). Alas, since it's not multithreaded, it's relatively slow. The 640 x 480 image in Figure 14 took about 13 seconds to calculate using a low maximum radius; higher settings take considerably longer.

Finally, we come to Glow. This, as far as I've been able to determine, is the only effect* feature that can take advantage of object IDs (set in MAX's Object Properties dialog) and Material Effects IDs (set in the Material Editor). As with the other effects, you can apply Glow to each RLA file as many times as you like. For each instance, you can direct the glow to affect a specific object ID or Material Effects ID and adjust the glow

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other particles swirling about a filmed actor's head, moving behind and in front without any intervention on your part. Note that you're not actually importing 3D data; for example, you can't rotate objects to view them from different angles.

If you do need to change a 3D object's depth relationship within the composition, you can adjust the Geometry panel's G-Buffer Z Offset setting. This doesn't change its size, though. Incidentally, the Geometry panel also has a G-Buffer Z Scale slider; this is used for tweaking the overall depth in the RLA image so that Offset settings make sense. In Figure 4, I've lowered the Offset value, moving the assembly closer so that part of the red ball is visible in front of the video. Note that the spheres and video frame are the same size as in Figure 3. You can also change the RLA image's position on the Z axis, causing the image to change in size, as in Figure 5. However, the depth relationship with other objects in the composition remains pretty much the same.

Thus, effect* doesn't give you the usual proportional relationship between distance from the camera and perceived size that we take for granted in the real world and in 3D apps' perspective/camera views. This is an unintuitive aspect of compositing 2D and pseudo-3D objects in effect* that takes some getting used to. It also manifests in another way: You can switch to a world view that's independent of the camera view, akin to Perspective versus Camera viewports in MAX (no orthogonal views are provided). In world view, you can zoom out and rotate your view around the composition/scene to get a better idea of objects' positional relationships. However, the pseudo-3D objects don't respond to such view transformations and often block your view of the other objects. You can turn off Use 3D Depth to see the RLA image's actual location in the composition, but then you lose the 3D functionality. It's evident that work remains to be done in fully incorporating RLA-enabled functionality into effect*.

The remaining RLA-related control in the Geometry panel is Use 3D Shading. If the global Shading switch is off, lights in the scene have no effect; all objects are lit as

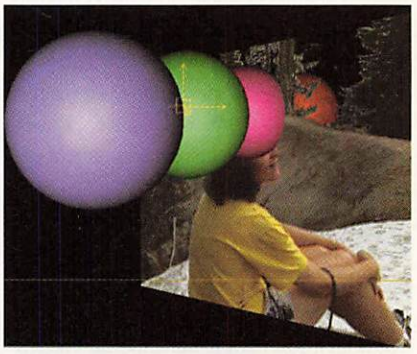

FIGURE 4. Lowering the Offset setting moves the RLA image closer.

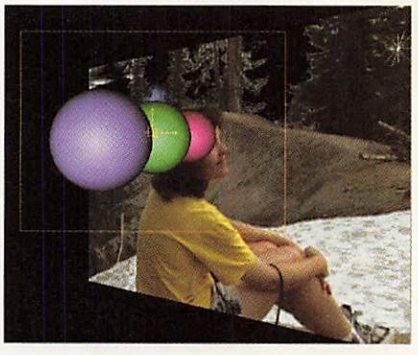

FIGURE 5. Moving the RLA image on the Z axis changes the size, but not the position.

BY DAVID DUBERMAN

2D in Z Space

The combination of Discreet 3D Studio MAX, effect*, and paint* is a compositing powerhouse. Here's how to make the most of it.

The closest thing we have today to *Star Trek*'s transporter is digital compositing. To beam something or someone into new surroundings, you photograph them against a blue or green screen, then use a program like Adobe After Effects to replace the background with any environment you can photograph, draw, or render. Perhaps the foremost example of this practice to date is the film *Titanic*, where many of the shots consisted of dozens or hundreds of separate images, composited together to make a seamless whole. To date, compositing has been done mostly in two dimensions, by layering flat images. But thanks to recent technological innovations, it's rapidly going boldly into the third dimension, allowing "actors" to move behind and in front of environment elements.

Most 3D programs support compositing in various forms. If you've ever used a photograph of the sky as a background in your scenes, consider yourself a virtual Scotty. But what if you want to combine 2D images and 3D objects in the same scene and have them interact naturally as if they were all real-world entities? You can kluge together a setup in any capable 3D app, but because any 3D elements must constantly be rerendered, chances are you won't get anything like real-time feedback, which discourages experimentation.

Enter effect*, a compositing program from Montreal-based Discreet (formerly Discreet Logic, now a division of Autodesk). Along with paint*, Discreet's vector-based 2D graphics program, these apps offer especially powerful compositing capabilities in conjunction with Discreet 3D Studio MAX, the 3D app from the Autodesk division formerly known as Kinetix. In this article, we'll explore the current state of integration among the three programs, with an emphasis on interoperation between effect* and MAX.

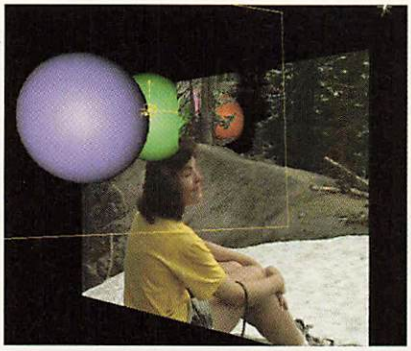

FIGURE 1. Compositing 2D frames in effect*.

In effect*, you can import digital video and still images and treat them as flat objects in layers. You can move, rotate, and scale them; apply lighting and shadows; and use a camera much as you would in a 3D app. And you can composite them using any inherent alpha information or, in the case of video, by creating an alpha channel on the fly by specifying one or more transparent color ranges. For example, in Figure 1, I composited a video sequence with a still image created in MAX. The latter is a TIFF rendering of four spheres against a black background. In effect*, I rotated both about their vertical axes and specified the TIFF image's alpha channel to be transparent. I also used effect*'s linear keyer to make the blue sky in the video transparent. The two images intersect in a straight line at the green sphere, as you'd expect with 2D objects, and the rearmost spheres appear through the transparent area in the video frame.

Compositing with effect* goes far beyond this conventional functionality to provide capabilities that can increase your creative options while saving render time. The difference is the RLA file format, which MAX can render to and effect* can import. RLA is a curious hybrid, consisting of 2D image data plus Z depth and other specialized data. Just as formats like TIFF and Targa include alpha transparency information in an additional channel as a grayscale image, RLA files contain a special G-buffer channel that also uses grayscale data, but in this case to represent relative depth of objects in the scene. White pixels indicate objects closest to the point of view, and darker pixels represent greater distance, as depicted in Figure 2.

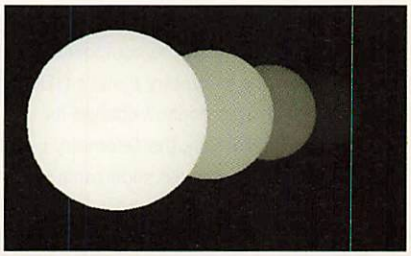

FIGURE 2. The G-buffer grayscale indicates distance.

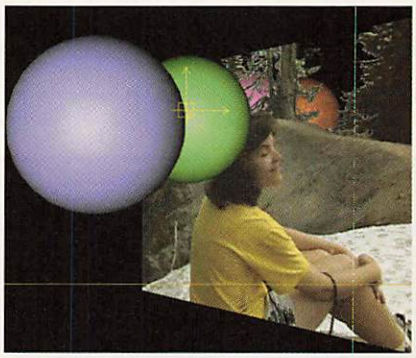

FIGURE 3. 3D compositing in effect*.

This feature of RLA opens up a new world of compositing possibilities in effect*. Take a look at Figure 3. To create this, I rerendered the four spheres, but specified the RLA format for output. In Setup for the RLA file, I turned on the Z channel. Then, when I brought it into effect*, I was able to turn on the Use 3D Depth switch on the Geometry panel. This lets effect* use the depth data for compositing, so the imported RLA images seem to contain 3D objects. That's why the outline of the green sphere is curved where the image intersects the video frame, rather than straight. If you output your 3D animations as RLA file sequences, this capability lets you create, for example, a constellation of spheres or

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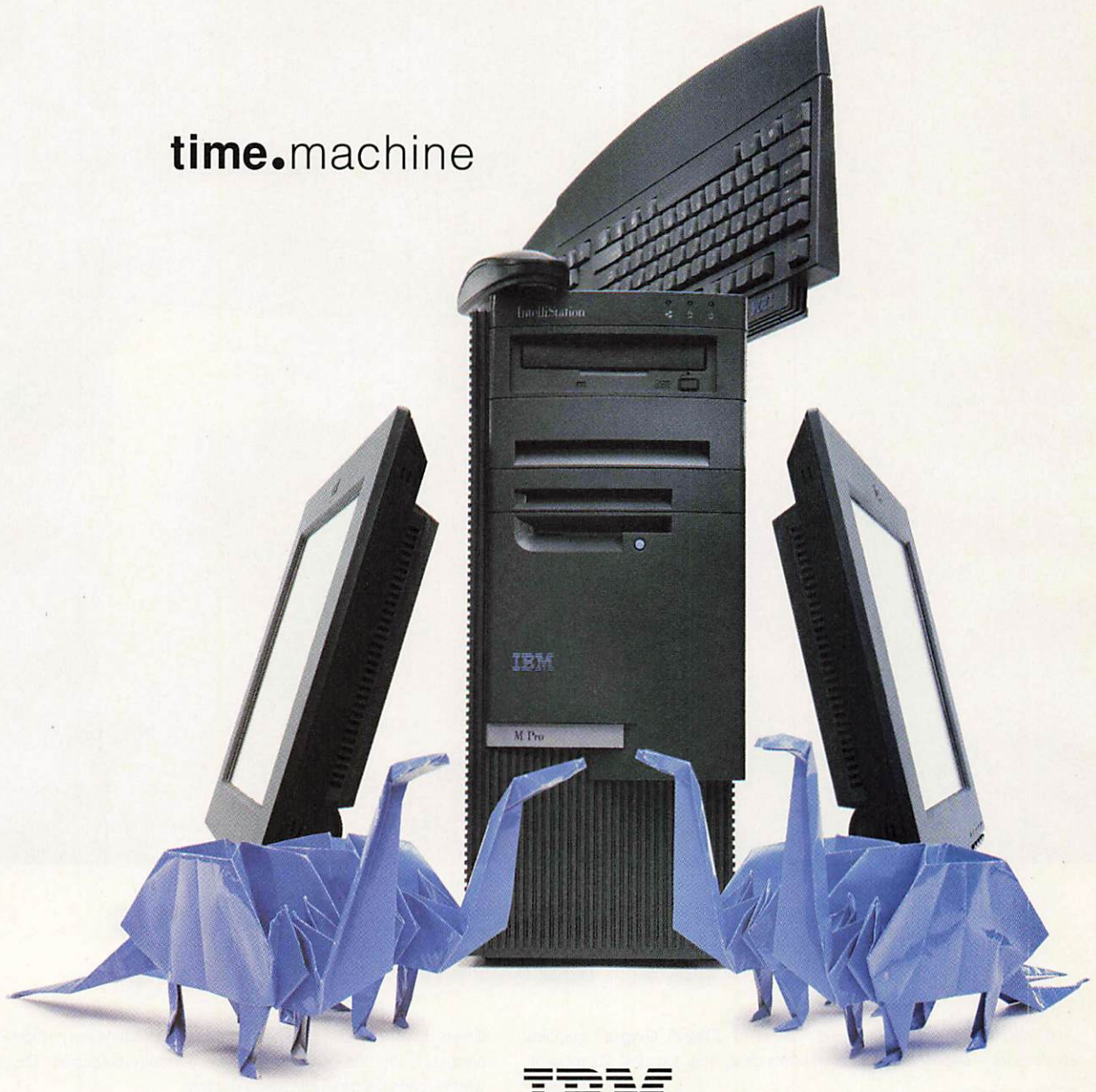

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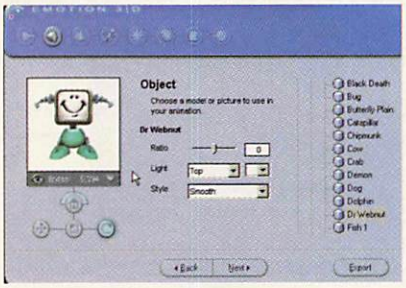


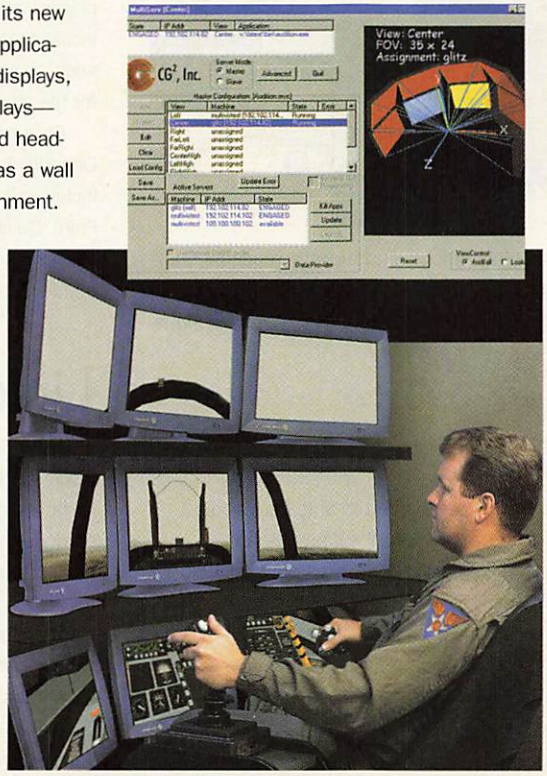
Emotion 3D: Web Edition ($69) is a new tool for Windows from Anark Interactive Media for creating web animation. Using Anark's AniMesh procedural animation engine, Emotion 3D can animate 3D objects or 2D images for JavaScript rollover buttons and animated GIFs. You select an image and one of 60 predefined behaviors, and Emotion 3D does the rest. The package also includes 2D and 3D clip art and background images. Emotion 3D can import 3DS and DirectX files and export animated GIF, JavaScript, WMF, JPG, and PSD. **RAPID 3D NO. 161**

Depth of Field & More

BlackFeet, based in Bordeaux, France, offers Dei Tools 2.0, a set of plug-ins for various Windows-based 3D apps, that includes Defocus Dei, Polygon Cruncher, and 3D Browser. Defocus Dei plugs into 3D Studio MAX, LightWave 3D, Amapi 3D, and Softimage and simulates depth of field. You can animate the field depth or apply it to a series of images; set the field depth on the first and last objects and the plug-in will interpolate. Polygon Cruncher plugs into MAX and LightWave, and it eliminates unnecessary polygons. 3D Browser, for MAX and LightWave, lets you create searchable thumbnail catalogs of 3D objects. Cost is approximately $69 each, depending on exhange rate; package deals are available. **RAPID 3D NO. 162**

One Image, Many Monitors

CG² Inc. announced MultiVis, its new software toolkit for enabling 3D applications to span multiple computer displays, without additional hardware. Displays—including monitors, projectors, and head-mounted units—can be stacked as a wall or set up as an immersive environment. MultiVis will work with a theoretically unlimited number of displays, networked PCs (Windows 95/98/NT), and any OpenGL-compliant 3D app. A little coding is required to integrate MultiVis' libraries with your application of choice. MultiVis doesn't split up the video output, but rather renders the view on each monitor or display separately. You can configure each monitor's orientation at runtime and adjust each view on the fly. Pricing has not yet been determined but is expected to be between $10,000 and $15,000. **RAPID 3D NO. 163**



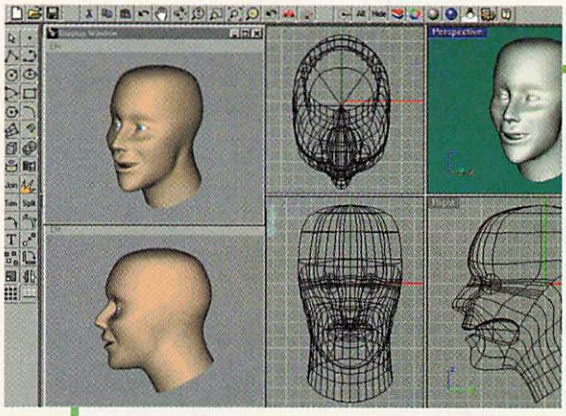
stray pixels

New from MGC Technologies is the MGC-15SP 15" LCD flat-panel monitor ($929) with built-in speakers, .30 dot pitch, and 1024x768 resolution at 75Hz. It can be viewed from a 160° horizontal area, providing good range for a flat-panel. It's both Mac- and PC-compatible. **RAPID 3D NO. 164**

Electrifier Inc. has announced Electrifier Pro 1.02 ($395), a tool for creating web-ready rich media, including sound, animation, 3D, Flash, QuickTime, and VR panoramas. Essentially, it's a QuickTime 4 authoring tool; few packages on the market can exploit all of QT4's features. A Windows version in development. **RAPID 3D NO. 165**

SupremeGS, maker of MediaStorm BeOS boxes, is now manufacturing Linux-based systems. The HyperStorm workstations come with Red Hat Linux 6.0 and are designed for back-end management of files, the web, and email. HyperStorm machines feature one or two 400MHz Pentium IIs, 10/100 Base-TX Ethernet, 8MB 2x AGP graphics card, and CD-ROM and SuperDisk drives. Single-processor HyperStorm is $1,699; the dual-processor HyperStorm Pro with more RAM and hard drive space is $2,350. **RAPID 3D NO. 166**

Digital Processing Systems (DPS), known for the Perception video board, has announced DPS Lockstep 3.0, a plug-in to 3D Studio MAX R3 that gives you control over Perception from within MAX. New features include the ability to output MAX's viewport previews to Perception and use the Perception as a frame buffer. It's available for free download to registered users at www.dps.com/software. **RAPID 3D NO. 167**

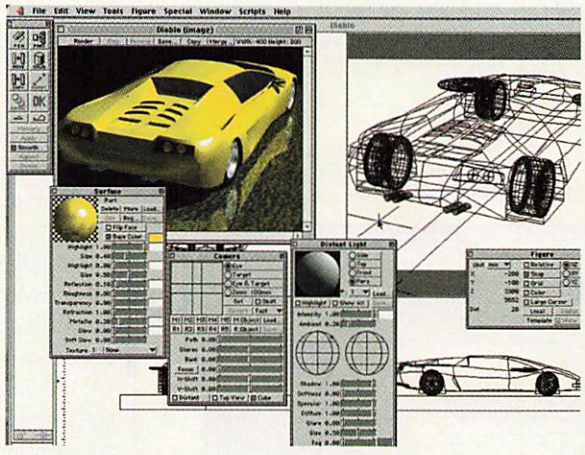


NURBS on Safari

Hunting for a Windows modeler? Set your sights on the latest from Robert McNeel & Associates. Designed for commercial and industrial product designers, CAD/CAM users, and multimedia and graphics professionals, Rhino 1.1 ($795) is capable of freeform curve, surface, and solid modeling. Along with a new streamlined user interface and user-configurable mouse, Rhino 1.1 adds support for 3D Studio MAX, AutoCAD 2000, ACIS, Parasolic, and OptiCAD. Rhino 1.1 includes Gazelle, McNeel's new nonlinear optimization technology for surface creation, fitting, and deformation.

RAPID 3D NO. 156

Turning Japanese



3D is hot in the land of the rising sun, so you might want to look into Expression Tools Shade Professional (148,000 yen), a modeling, rendering, and animation package from Japan. Available for Mac and Windows, Shade Professional offers Bezier curve and Bezier curve surface modeling, environmental settings, and raytrace rendering. Animation tools include morphing, joint animation, and IK. A plug-in API is available. (Shade Debut and Shade Personal are the less expensive, less feature-rich versions.) A free demo is available at www.ex-tools.co.jp. **RAPID 3D NO. 157**

More 3D in After Effects

Adobe After Effects 4.1 ($1,499) is on the horizon, scheduled to ship for Mac and Windows Q3 1999, and will include much more support for 3D. You'll be able to import and manipulate 3D objects and channels and use filters such as depth of field and fog. Other improvements include a network renderer for images up to 30,000x30,000 pixels, flowchart-style file tracking, and enhanced support for keyframable masking (for example, animating the opacity of multiple masks on one layer). A new API will give plug-in developers access to layers, keyframes, and 3D channels, and improve QuickTime 4 export. **RAPID 3D NO. 158**

The Legacy Continues

The legacies of Infini-D and Ray Dream have been in question since MetaCreations acquired those products a couple of years ago. Finally, the company has laid questions to rest, retiring their war horses and introducing a synthesis of the two, Carrara (pricing to be determined).

Running on Windows and Macintosh, Carrara is touted as a one-stop shop suitable for beginners and professionals alike. The user interface posits each phase of production as a separate room—storyboarding, modeling, animation, texturing, lighting, and rendering—each with its own tool set. Features include spline, vertex, metaball, and extruded-font modeling; keyframe, motion path, and simulated physics animation; several renderers including selective raytracing; and effects such as particles and motion blur. The SDK for the plug-in API is freely available online.

Carrara supports Open GL and Direct3D hardware and popular file formats including Adobe Photoshop, Corel PhotoPaint, QuickTime, TrueType, PostScript, MetaStream, VRML 2.0, DXF, OBJ, 3DS, and RDS. **RAPID 3D NO. 159**

Linked Up 3D

From Global Majic Software comes 3DLinX, a language-independent environment for real-time 3D application development and rendering. 3DlinX allows programmers of Visual Basic, Java, and other languages to incorporate 3D elements into their programs or create 3D games and applications from the ground up with little programming. Based on Microsoft's ActiveX technology, 3DlinX is Windows-only. **RAPID 3D NO. 160**

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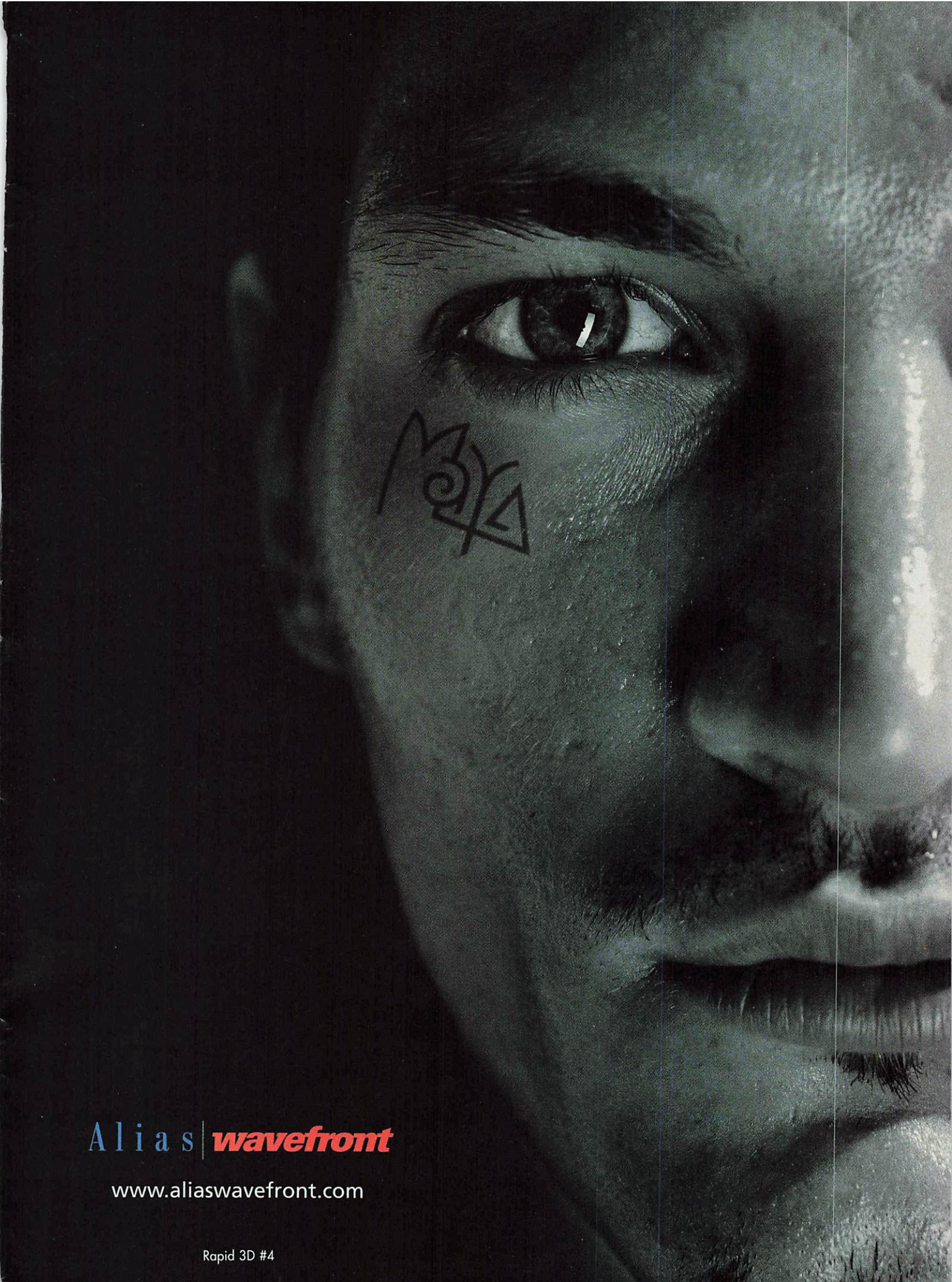
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jects for Excite, WebTV, and Real Networks among others, and will continue new-media work with creative director Margeigh Joy. A core group of digital artists and directors is forming a new production shop.

The Bundled World

The convergence continues: not just TV and computers but software and software. More bundle deals are being announced all the time. Avid has been busy; REALVIZ MatchMover is shipping with a pay-per-use license in Softimage 3D 3.8 SP2 (likely the final precursor to next-generation Sumatra; more on that next month in our SIGGRAPH coverage). MatchMover tracks camera movements so you can integrate live-action and CG footage. When you have something you're ready to export to Softimage 3D for completion, you'll need to pay the per-use license fee.

REALVIZ is among the first tool vendors to use this pay-per-use license. It dramatically reduces the initial cost of high-end software such as MatchMover (a full-use license is $10,000).

In another Avid box, Puffin Designs Commotion will be bundled with a broad range of Avid's editing packages, including Xpress and Media Composer. Commotion's arsenal of video effects should speed an Avid user's workflow.

It's not quite a bundle, but it's an agreement: Adobe is licensing Kazoo's 3D toolkit for its consumer-level products. Kazoo, a division of LightWork Design, has developed a simple, user-friendly technology for creating 3D art with intuitive model-manipulation and painting techniques. That should be a good fit with products such as GoLive, Adobe's top-end web site creation software.

Improv Intro

Improv Technologies made its debut at SIGGRAPH 99. During the next two years, Improv plans to release tools for animation, special effects, and game production. Its technology is based on research from New York University's Media Research Laboratory and the Center for Advanced Technology. The core algorithms were developed by Dr. Ken Perlin and Thomas Goldberg. Perlin received an Academy Award for his noise and turbulence algorithms used in films such as *Jurassic Park*, *The Lion King*, and *Terminator 2*. The company plans to launch its first product, Orchestrate3D, in March 2000.

Did You Say Free?

In the free software department, Cyberworld International Corp. announced that its Cyberworld Consumer Edition, which adds 3D elements to web sites, is available for free download from www.cyberworldcorp.com. You can add your images, sounds, and movie files to web pages through Cyberworld's user interface to create mini-3D worlds. Prebuilt worlds are available for purchase, and a Professional Edition with more authoring tools and features is in the works.

Apple Comes on Strong at Seybold

The auditorium was crowded to capacity. Publishers, Internet jocks, prepress and print professionals, and yes, 3D artists and animators came to hear Steve Jobs, venerable leader of the Macintosh faithful, deliver the keynote address at Seybold San Francisco on August 31, 1999.

Looking like Gentle Ben in his full beard, Jobs announced Apple's seventh profitable quarter since he steered the company out of dire straits two years ago. The QuickTime-format *Star Wars Episode One* trailer, he reported, has been downloaded more than 25 million times. The trailer accounted for 450 terabytes of Internet traffic and lent credence to Jobs' concept of "QuickTime TV"—ubiquitous netcasting capability thanks to the open-source Darwin streaming server for QuickTime, which runs on MacOS, Windows, and Linux.

Next, Jobs focused on MacOS 9. A built-in voice password system locks other users out of your computer. On the other hand, multiple configs can be stored for multiple users, making it possible to set up a public machine to your liking in a few clicks. OS9 can update itself by searching the web as frequently as once a day for updates, and files can be shared over the Internet.

After recapping the successes of the iMac, iBook and G3, Jobs reached the topic that everyone had been waiting for: the G4, which he dubbed "supercomputer on a chip." The G4 has a peak performance of 4Gflops thanks to the incorporation of the Velocity Engine, a super-duper 128-bit floating-point processor. According to Jobs, the G4 clocks in at 2.94 times the speed of the PIII running Intel's own benchmarks.

Applause erupted when Jobs unveiled the new silver, graphite, and white G4 boxes, looking like G3s but with three times the memory bandwidth and twice the PCI bus throughput. Models were introduced in 400MHz, 450MHz, and 500MHz configurations (the latter with a 5GB DVD-RAM drive), ranging in price from $1,599 to $3,499.

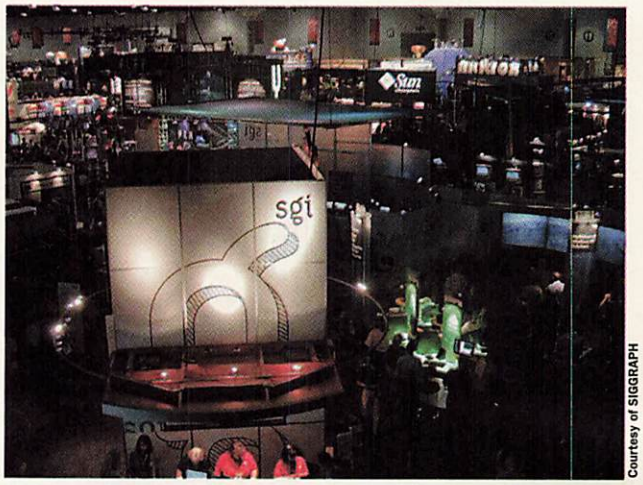
VP of worldwide marketing Phil Schiller pitted a G4 against a PIII using Photoshop and a plug-in that enables the app to take advantage of the Velocity Engine. The G4 bested the PIII by more than double. Schiller dazzled the crowd with similar results in other tests.

Jobs closed out the keynote by announcing the ultimate companion to the G4, a new StudioDisplay dubbed the CinemaDisplay ($3,999). A 22-inch flat-panel LCD that displays 11x17-inch documents at 1600x1024-pixel resolution with room to spare for toolbars. Movies play back without ghosting. The CinemaDisplay will be available only bundled with 450MHz and 500MHz G4s.

BY MATTHEW HOOVER

A Successful SIGGRAPH

Plus SGI's continued restructuring, a glance at 3dfx's numbers, and a look at the new Apples.



Courtesy of SIGGRAPH

Looking down at the exhibition floor at SIGGRAPH 99.

42,690 people celebrated the digital arts at the SIGGRAPH 99 conference and exhibition held at the Los Angeles Convention Center August 9-13, 1999, the organization reports. Covering 154,000 square feet of exhibit space, 337 companies displayed their hi-tech products and services. The conferences, galleries, films, and classes were full of today's latest technology but also looked forward to the convergence of video, computers, and television.

Look for comprehensive SIGGRAPH coverage—new 3D software, not-yet-software technology, boxes and cards, interactive media, and more—in the December issue of *3D* magazine.

A Bumpy SGI Roadmap

There's nothing like taking hits when you're already down, and SGI knows this feeling all too well. Recent shakeups at the company include the surprise resignation on August 23, 1999, of CEO Rick Beluzzo, who came aboard from Hewlett Packard about two years ago, vowing to return the company to profitability. This he accomplished for one quarter, but with big troubles looming even after drastic layoffs and restructuring, he bowed out. Beluzzo is succeeded by Bob Bishop, SGI board member and the company's largest single shareholder.

As announced at SIGGRAPH, SGI laid off more than 1,500 employees, including engineers, marketers, and even the lead Fahrenheit evangelist, leading many to believe that the company will eventually drop out of the joint graphics API initiative with Microsoft.

SGI will spin off its Cray supercomputer division, which will carry forward the current product roadmap of vector-based solutions to be developed in conjunction with SGI's next-generation ccNUMA-based server products.

SGI will be pulling back from its commitment to Windows NT and eventually IRIX in favor of the open-source Linux OS. Linux is already shipping on SGI 1400L servers, and the company announced that it's looking for a manufacturing and distribution partner for its Visual Workstation 320 and 540 NT-based PCs. The current juicy rumors are that Dell and Toshiba are taking a look under the hood, but we were unable to confirm that by press time.

3dfx Sells More But Earns Less

Previously known as a gaming-card company, 3dfx continues its charge into the higher end, with acceleration powerful enough for 3D artists in products like the Voodoo3 3500. The company announced revenue of $145 million for the first half of 1999, up from $109 million during the first half of 1998. But that still added up to a loss of $0.71 per share.

Greg Ballard, president and CEO, placed some blame for the loss with the timing of the STB merger, which wasn't consummated til mid-May, keeping some Voodoo3 sales off the first-half books.

3dfx reaffirmed its commitment to the Macintosh platform, announcing Mac drivers in development (betas available at www.3dfx.com). In an interview with TigerInvestor.com, senior VP of finance Jim Hopkins said the company is after more of the Mac market. "We would like to have some of the OEM business that ATI currently has with Apple," says Hopkins. Mactell Corp., among others, is licensing Voodoo3 chips to make Mac graphics boards. 3dfx claims these will be the fastest cards ever available for the Mac, but in the hyperfast world of graphics accelerators, today's fastest rarely is for long.

A Colossal End

After 23 years of animating, producing, and designing, (Colossal) Pictures closed shop on August 31, 1999. The San Francisco-based studio had made a comeback after filing for bankruptcy in 1996, but in early 1999 revenue began to drop off and the mountain of debt was too tall. The company couldn't sustain its overhead while waiting to hear about potential work.

(Colossal) became well-known through its branding and design work for clients such as Levi's and MTV. The studio developed the series "Liquid Television" and "Aeon Flux" for MTV, then branched out to special effects for movies such as *Bram Stoker's Dracula* and music videos for the Grateful Dead and others. The company worked for the biggest ad agencies, created branding and IDs for almost every TV network, and won almost every major industry award.

Drew Takahashi, cofounder and chief creative officer, has been working on interactive pro-

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Too Much Info?

In Ted Greenwald's column ("Print vs. the Internet," September 1999), he pointed out many advantages an online magazine has over the traditional printed publication. I have to agree with all of them, but the printed publication has one very big advantage over the web—you can read it anywhere you go. So please continue to print your great magazine untill I can get an Internet connection in my bathroom.

Steve Turgeon
via the Internet

Paper or Content?

I'm the former webmaster for *NewTekniques* magazine, and I read with great interest the editorial "Print vs. the Internet," but I disagree with your prognosis. Here's why:

When television was introduced, people saw it as a great teaching tool. So, people put a camera in a classroom, filmed the entire session, then broadcast the raw, unedited material on television sets in every classroom, thus replacing teachers. The result was a disaster. You couldn't apply old thinking to a new medium. Same thing happened when moving pictures debuted early this century. You couldn't just simply apply traditional theater thinking to the new medium. You had to reinvent the whole concept. Same is true with the web—you can't apply paper thinking to it. For instance, you can't charge people for reading stuff on your site. Besides, much of the material in print can be found for free on the web. Visit a company's web site for the specs on the latest software. Visit the newsgroups to check out what other users think about it. Of course, it's not as straightforward as reading *3D*, but the information is there if you care to look.

A few months before leaving *NewTekniques*, I asked a few readers two questions. "If you had to choose between reading an article in a magazine or on the web, which would you prefer?" Most said paper. However, when I reformulated the question to, "Paper and the printing process cost a lot of money. Simply putting together a glitzy color publication such as *3D* costs more than the articles printed in them. So, in other words, companies pay more for the paper than they do for content. If you had to choose between paper or content, which would you choose?" Almost everyone answered content.

Does *3D* live for the content or the printing press? Today's business model is radically different, but those who understand it have become giants.

Jean-Eric Hénault
via the Internet

We want you

What do you think of *3D*? Post your letters and comments at the *3D* web site at www.3Dgate.com, mail them to us at: *3D* Letters, 525 Market St., Suite 500, San Francisco, CA 94105, or e-mail 3d@mfi.com.

Please include your full name, city, and state. We reserve the right to edit letters for clarity.

Try Before You Buy

Chris Tome's article about software piracy was very interesting and pertinent to me ("RTFM—If You've Got One," September 1999). I am a high school student and do a lot of 3D modeling. When shopping for a 3D package, I was grateful that Caligari offers a student discount on trueSpace4. Though they didn't publicize their educational discount, I learned about it after an email to customer service. This cut the price in half for me, putting it within my price range. Educational discounts keep me from resorting to the many cracked versions of Maya and 3D Studio MAX. Companies that offer student discounts help create not only good will but an experienced and honest group of customers for their next generation of clients.

Dan Malech
Bethesda, MD

Magazine Dongles

I've found a web site that scans magazines, including *3D*, and publishes them on the web for free—and best of all, they remove all the ads!

After reading Chris Tome's column about piracy, I've decided to cancel my subscription and read your magazine at this web site. If I find this month's issue to be interesting, I promptly go to my local newsstand and pay them $3.95. If I read through the issue and find it has no relevant information, I save the $3.95. I'm recommending this system to my friends as well.

Why should we spend our money for a year's worth of magazines without knowing what we're paying for? I thank you for bringing this new purchasing paradigm to light.

David Lenihan
via the Internet (of course)

Streaming on Paper

I appreciated the timely article "Streaming Web 3D" (September 1999, by Douglas A. Sahlin). My September *3D* came across my desk on August 2, just as I was preparing my final comments and background material for a lecture at SIGGRAPH 99, "Internetworked 3D Graphics." To my delight, Sahlin's discussion on MetaCreations MetaStream format and his comparision of MetaSteam to Cycore Cult3D provided me with timely content for my overview of 3D interactive graphics on the Internet. Thanks again for the excellent up-to-the minute coverage.

Theresa-Marie Rhyne
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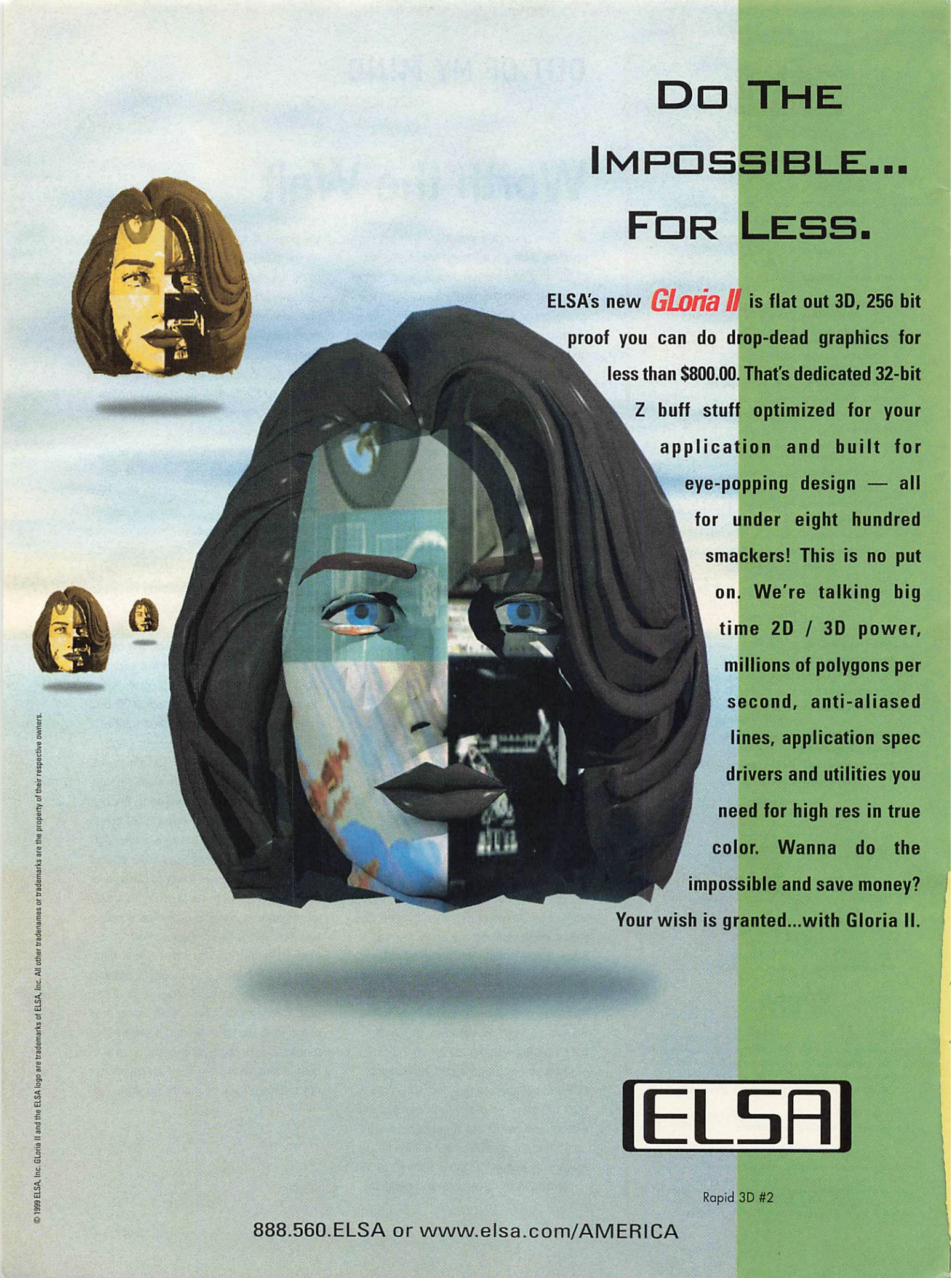
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Worth the Wait

Ever since the invention of linear perspective during the Renaissance, the art of painting has been moving toward that of sculpture. With this year's SIGGRAPH, the convergence entered its final phase. When the pixels settle, there will be little distinction between the 2D and 3D, at least from an artistic standpoint. We'll be able to jump back and forth effortlessly between the two.

The new phase has been coming for some time. Tools that measure parallax to derive 3D data from two or more photos shot at different angles, such as Synthonics RVR, have been performing 2D-to-3D conversions for a few years. The same principle yielded the magic of optical motion capture, ably represented at SIGGRAPH 99 by the Vicon 8RT, which is capable of performing all the calculations necessary to turn multiple video images into 3D motion data in real time.

Another harbinger was the past year's spate of match-moving tools, including Kaydara FiLMBOX matchmove, REALVIZ MatchMover, and SynaPix MatchMaker, which can extract camera motion, pan, tilt, and zoom from live-action footage and export it to MAX, Maya, Softimage, and/or LightWave. In addition, Puffin Commotion, a video paint tool, now exports camera pan and tilt data to Electric Image.

While the developers of these tools were striving to extract depth from flat images, others were enhancing flat images with depth data. In the days before Softimage|3D ran on NT, it exchanged files with a video compositing app known as Eddie. Eddie could read Softimage|3D's ZPIC image file format, which encoded not only pixel data but Z depth and object IDs. The extra data enabled Eddie to generate 3D effects such as shadows, depth of field, and fog within a 2D environment.

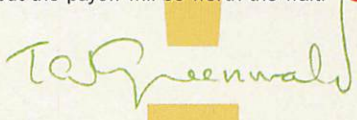
Just before they merged, Kinetix and Discreet collaborated to give 3D Studio MAX the same kind of interoperability with effect* and paint*. As it happens, you'll find a tutorial on these capabilities in these very pages ("2D in Z Space," p. 19).

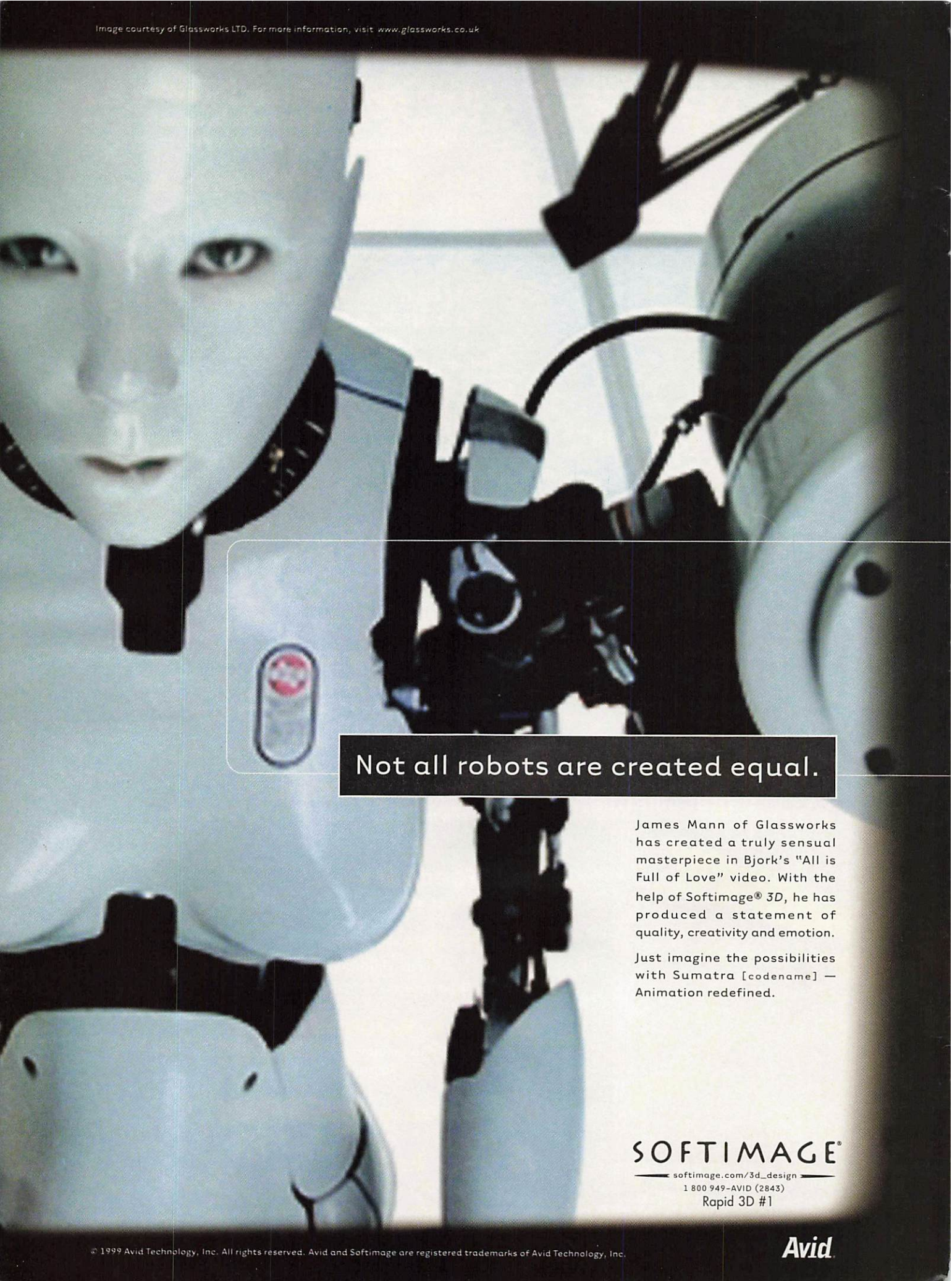
At SIGGRAPH, Adobe acknowledged the power of these capabilities by jumping on the bandwagon. After Effects 4.1 (due to be released by the time you read this) can take advantage of object IDs, Z depth, normals, and texture coordinates encoded in a variety of filetypes (ZPIC, RLA, and Electric Image EIZ, but not Alias|Wavefront IFF). It's a good bet that, from now on, this sort of 3D file format support will be considered *de rigeuer* in compositing software.

Meanwhile, over at the Avid booth, Softimage took 2D/3D integration to the next level. The upcoming version of Softimage|3D, due by the end of the year, can render directly to the file format of Softimage|DS (progeny of Eddie) for compositing. In this format, if 3D objects are updated or swapped, the composition doesn't need to be rebuilt from scratch; it simply needs to be rerendered by Softimage|DS.

The ultimate expression of 2D/3D convergence at SIGGRAPH 99 was the debut of Pixologic ZBrush (for Windows and Mac). ZBrush is a 2D paint program, and it does all the things you'd expect a 2D paint program to do—but it also does a lot of things you'd expect a 3D modeling and rendering program to do. A ZBrush object can be sculpted Amorphium-style, rotated, and textured until you move on to the next one, at which time it becomes a 2D object. Object ID and Z depth are retained for lighting, procedural texturing, and other effects.

The ability to move freely between two dimensions and three is a luxury that digital artists may come to regard as a necessity. Although it's a wonderful shortcut, it's more than that. It's one more step toward optimizing the creative impulse by providing the opportunity to make changes at any point during production without losing any of the work you've done, and it seems likely to lead to new styles of expression. It's been a long time since the Renaissance, but the payoff will be worth the wait.

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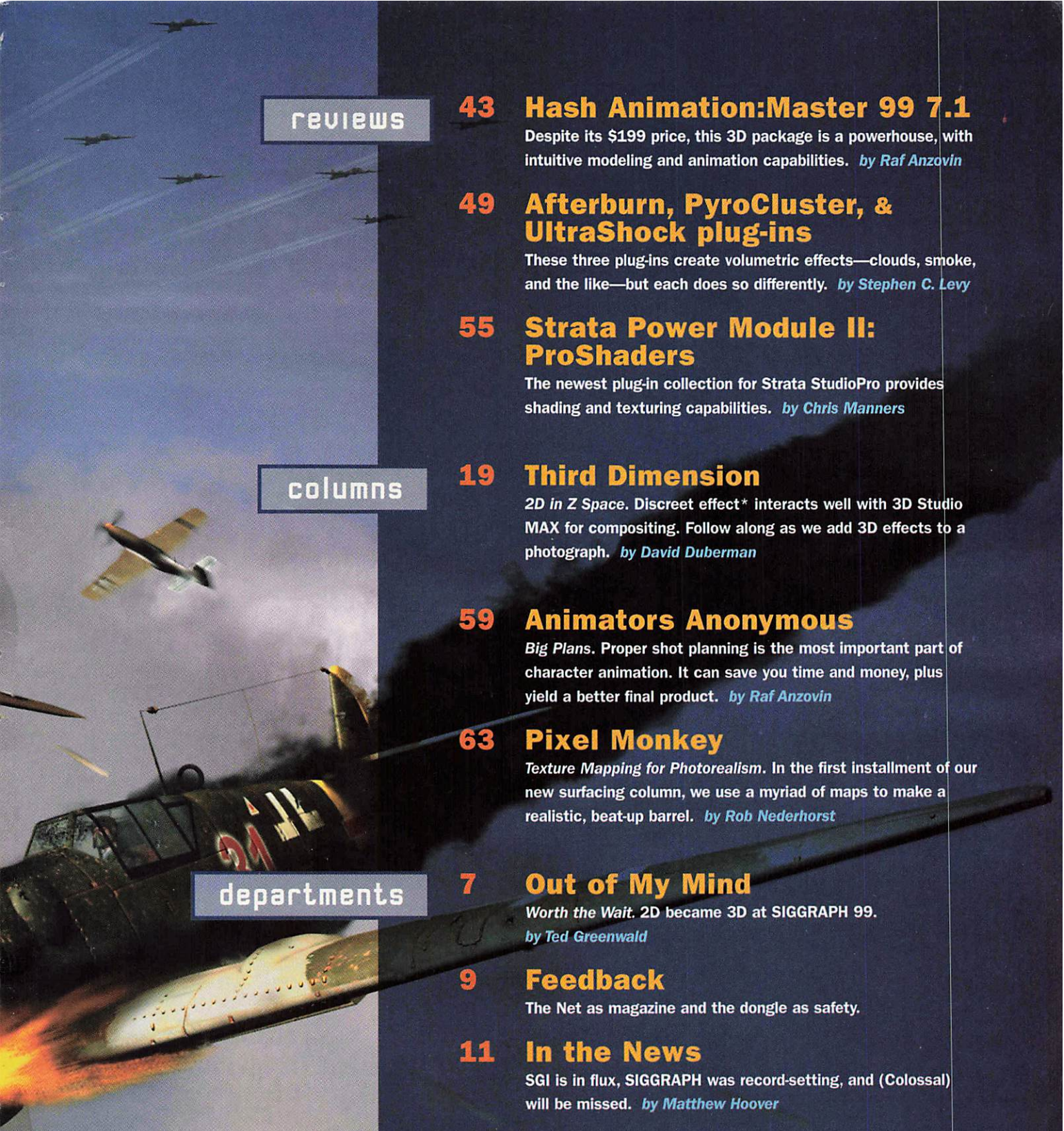

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